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Taking a 2D piece of art and adding the third dimension can be tricky, but check out our cover art! Ant Ward's stunning portrait does this perfectly and he shares his process step by step, on page 48.

If it's big-budget CG you're interested in, then discover *Abominable* on page 26.

Rob

Rob Redman, Editor
rob.redman@futurenet.com

SPOTLIGHT ON OUR CONTRIBUTORS



Adam Dewhirst

Adam Dewhirst is a veteran visual effects artist. On page 40 he explores the possibilities of using your iPad as a mobile studio.

www.instagram.com/dewhirstadam



Antony Ward

Antony has worked for many of today's top VFX and game studios. This month he demonstrates how to create stylised 3D portraits.

www.anticgi.co.uk



Ian Failes

Ian is a regular contributor to *3D World*, and in this issue he takes you behind the scenes on the hit movie, *Abominable*.

www.beforesandafters.com



Adam Barnes

Freelance writer and editor Adam Barnes takes us into the exciting world of *Dreams* for the PS4 over on page 18.

www.adambarnes.info



Alejandro Treviño

Self-taught independent 3D artist Alejandro Treviño showcases the process behind his amazing Laser Cowboy image on page 62.

aendom.com



Mike Griggs

Mike Griggs is a 3D and visual effects artist with vast experience across the industry, which he shares on pages 68-71 in our Basics and Bootcamp.

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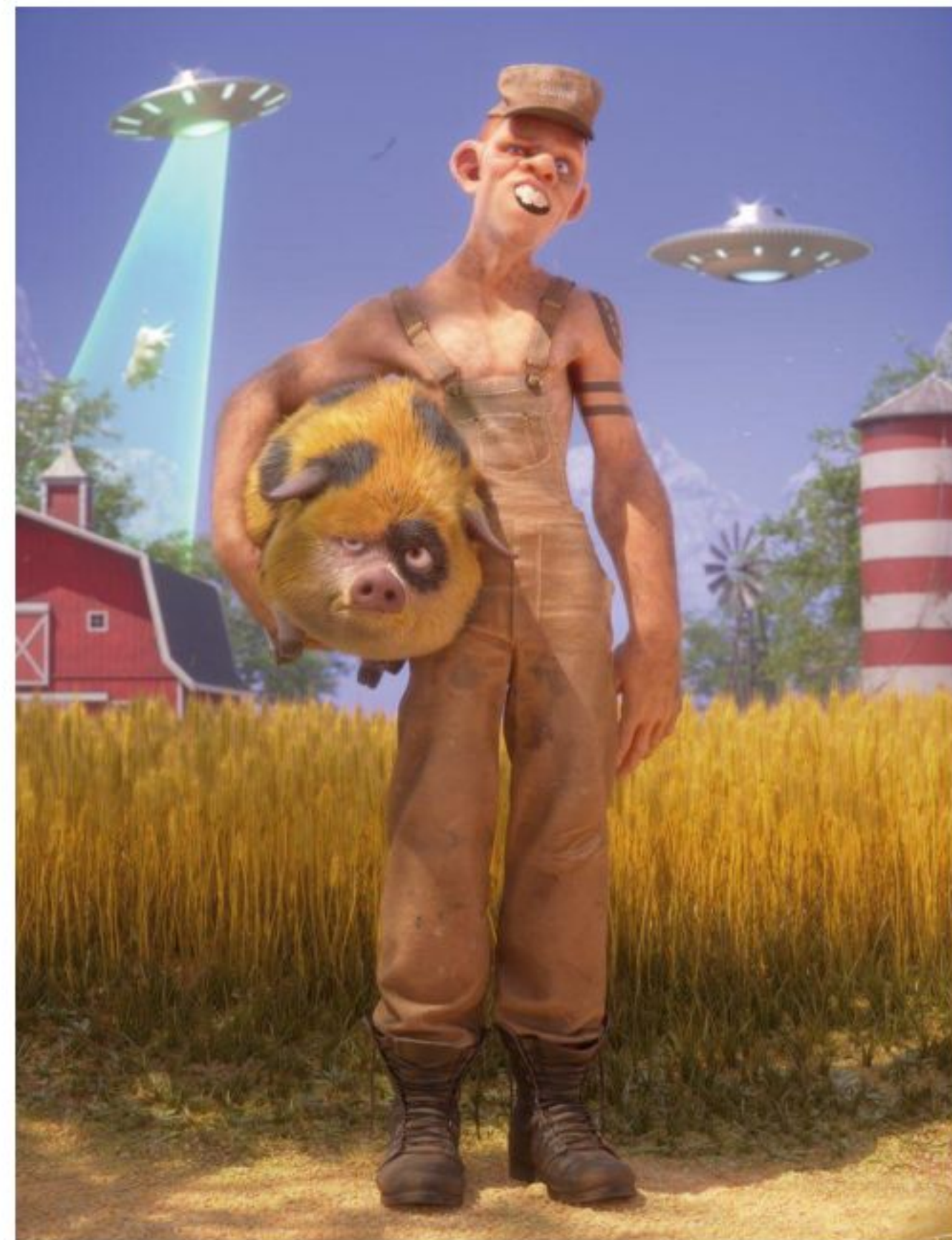
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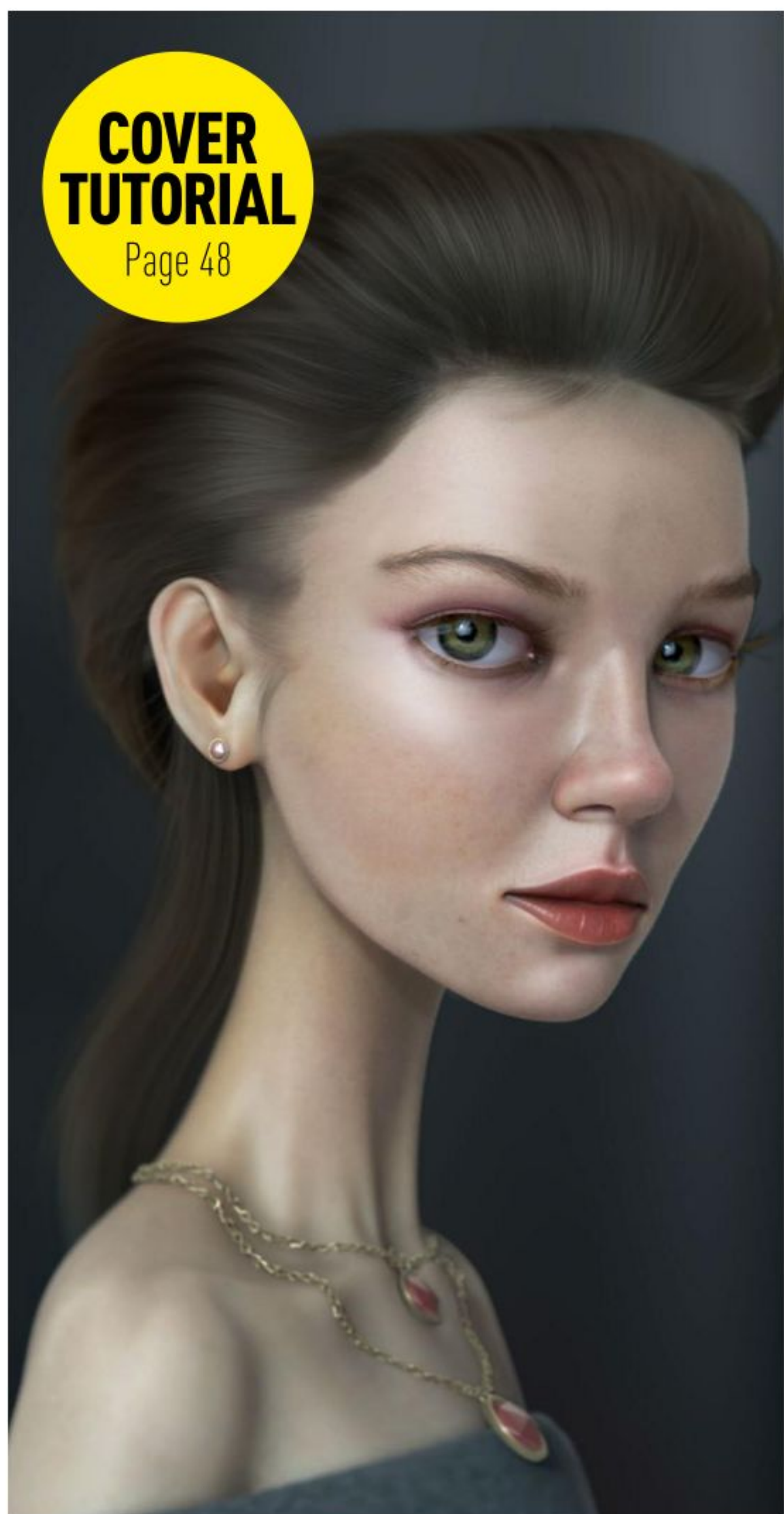


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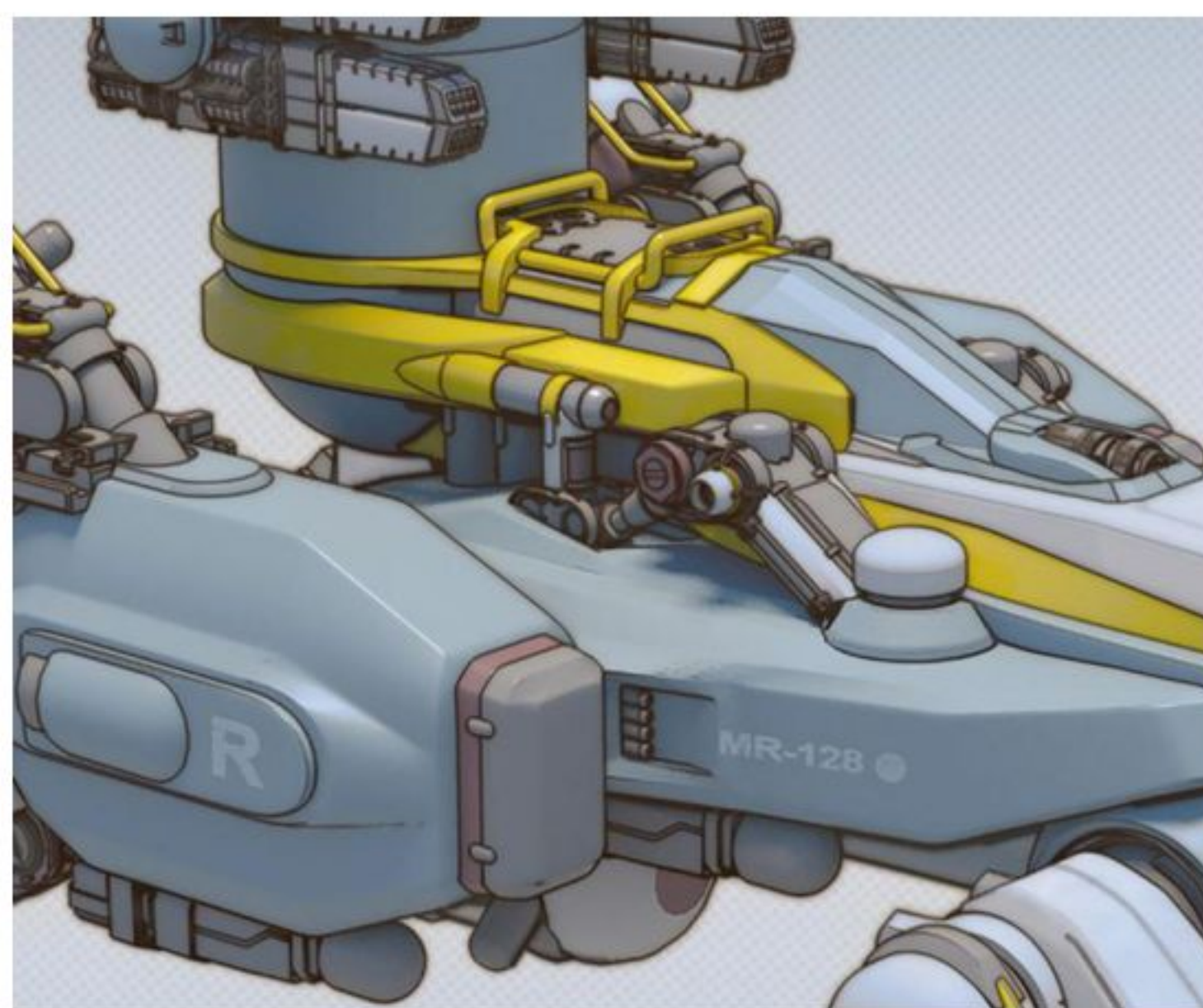
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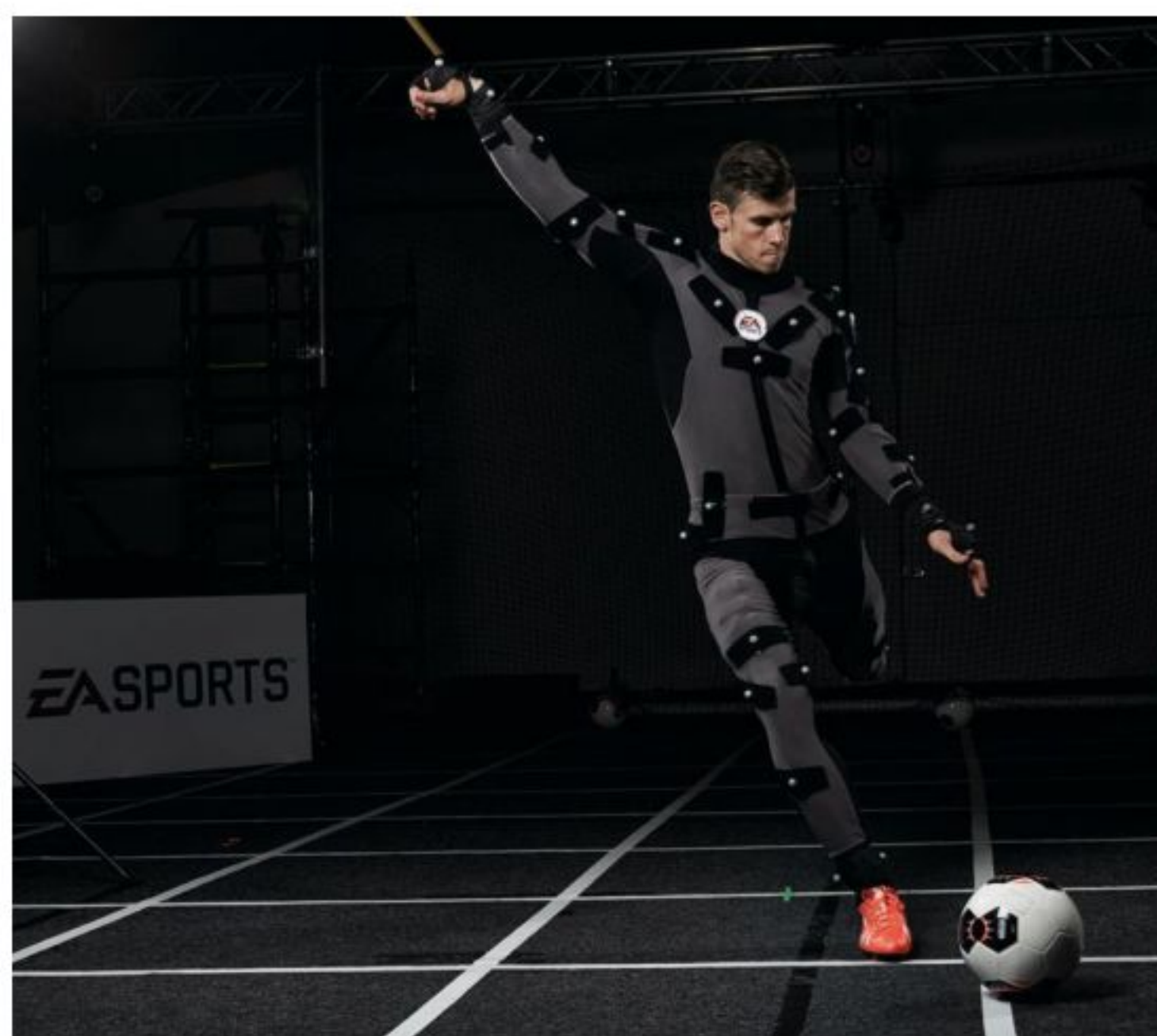
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Future Publishing Ltd
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Bournemouth, Dorset, BH2 6EZ
+44 (0) 1202 586200
✉ 3dworld@futurenet.com
📺 3dworld.creativebloq.com
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EDITOR Rob Redman
3dworld@futurenet.com
PRODUCTION EDITOR Rachel Terzian
DESIGNER Ryan Wells
STAFF WRITER Brad Thorne
SENIOR ART EDITOR Will Shum
EDITOR-IN-CHIEF Claire Howlett

CREATIVE BLOQ

EDITOR Kerrie Hughes

CONTRIBUTORS

Cirstyn Bech-Yagher, Adam Barnes, Pietro Chiovaro, Maya Jermy, Ian Failles, Haimeng Cao, Mike Griggs, Antony Ward, Orestis Bastounis, Alejandro Treviño, Adam Dewhirst, Georgina Hurcombe, Kylie Eaton

COVER IMAGE

Antony Ward

ADVERTISING

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CHIEF REVENUE OFFICER Zack Sullivan
UK COMMERCIAL SALES DIRECTOR Clare Dove
ADVERTISING SALES MANAGER Mike Pyatt
ACCOUNT SALES DIRECTOR Matt Bailey
ACCOUNT SALES DIRECTOR George Lucas
ACCOUNT SALES MANAGER Tom Walsh

INTERNATIONAL LICENSING

3D World is available for licensing. Contact the Licensing team to discuss partnership opportunities.
HEAD OF PRINT LICENSING Rachel Shaw
licensing@futurenet.com

SUBSCRIPTIONS

EMAIL ENQUIRIES
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INTERNATIONAL +44 (0) 344 848 2852
ONLINE ORDERS www.myfavouritemagazines.co.uk
GROUP MARKETING DIRECTOR, MAGAZINES & MEMBERSHIPS Sharon Todd

CIRCULATION

HEAD OF NEWSTRADE Tim Mathers
tim.mathers@futurenet.com

PRODUCTION

HEAD OF PRODUCTION US & UK Mark Constance
PRODUCTION PROJECT MANAGER Clare Scott
ADVERTISING PRODUCTION MANAGER Joanne Crosby
DIGITAL EDITIONS CONTROLLER Jason Hudson
PRODUCTION MANAGER Nola Cokely

MANAGEMENT

MANAGING DIRECTOR - PROSUMER Keith Walker
CHIEF OPERATIONS OFFICER Aaron Asadi
COMMERCIAL FINANCE DIRECTOR Dan Jotcham
GROUP CONTENT DIRECTOR Paul Newman
HEAD OF ART & DESIGN Greg Whitaker

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PERSEUS



ARTIST
Farzad Maleki
SOFTWARE
ZBrush, KeyShot

Freelance creature and character artist Farzad Maleki spent a total of 400 hours, over four months, creating this piece of Greek mythology in 3D. Although his passion lies in sculpting, Maleki is skilled in lighting, texturing, animating and rendering. “I’m inspired by old paintings and sculptures,” he says. “What really attracts my attention is how they created the world’s greatest artwork using only simple tools and their patience.”

Maleki used ZBrush to create the clothes, which did not require many

wrinkles or a huge amount of depth. “Boolean was a very useful technique for making some holes and wrinkles,” he adds. What Maleki enjoyed most was the composition stage, creating the scene in a way that showed principles of design such as balance, movement, rhythm and harmony. He also wanted to ensure that the final piece was similar to the painting on which it was based.

“I worked on the composition in two stages,” Maleki explains. “The first was at the beginning of the project and then

again at the end when it was about 90 per cent complete and the shadows were visible.”

In the final stage Maleki begins sculpting his SubTools one by one, “some of those are very high poly and need a lot of work to avoid crashing the program,” he adds. “In these cases I reduce the number of polygons using Decimation Master. Sometimes I use objects that I’ve already built in my previous projects.”

● [instagram.com/farzadmalekiart](https://www.instagram.com/farzadmalekiart)



BOOLEAN WAS A VERY
USEFUL TECHNIQUE
FOR MAKING SOME HOLES
AND WRINKLES



UNDEAD WARLORD



ARTIST

Bruno Camara

SOFTWARE

ZBrush, 3ds Max, Marvelous Designer, Substance Painter, V-Ray, Photoshop

By day Brazil-based character artist Bruno Camara provides digital creatures and characters for film and video game companies overseas, as well as teaching online workshops. Previously he has sculpted for collectible figurines. Camara's fantastical imagery is heavily inspired by legendary artists such as Frank Frazetta.

"I always start by sketching everything in ZBrush," Camara explains. Keeping a scale of around 180cm, he employs 3ds Max for complex shapes and intricate mechanical elements. It is this part of the project that Camara enjoys most, "things start to look the way you imagined," he adds. A Marvelous Designer simulation allowed Camara to achieve the natural look of the Warlord's cape.

After the sketch, Camara will retopologise everything using ZRemesher and 3ds Max. "I also work on the UVs using ZBrush and Max," he continues. "From the UVs I will jump into detailing in ZBrush and export all the displacement maps." Using Substance Painter to texture, Camara exports his colour, glossiness and bump maps, before preparing his scene and lights in 3ds Max and rendering with V-Ray.

● artstation.com/brunocamara



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CLETUS



ARTIST

Kevin Beckers

SOFTWARE

ZBrush, V-Ray Next, 3ds Max, Substance Painter, Forest Pack, Ornatix, After Effects, Marvelous Designer

Freelance character developer Kevin Beckers spent two weeks on this otherworldly image. “I don’t think I did anything particularly unusual,” he tells **3D World**. “I used each software as intended, grooming with Ornatix, clothes with Marvelous Designer, etc. No special tricks.”

The fun nature of Beckers’ image helped to make the artistic process enjoyable. “I liked the pig a lot, it made me smile,” he adds. “I was hoping to achieve that hot, dusty summer day feeling.”

“I tend to rely on concept art from the client or I assemble a mood board full of ideas,” says Beckers. He then blocks out

rough shapes in ZBrush. “If it’s an entire scene I will take it into 3ds Max and start finding a composition that I think works,” he continues. “Once I have something I like I will bounce it back and forth between Max and ZBrush to do detailing and build up the scene with some finishing touches.”

Much of Beckers’ inspiration comes from the community of amazing artists that surrounds him: “Like Tyler Bolyard for example, his work is so clean and balanced, I look at it a lot. I’m influenced by a lot of the great artwork out there.”

● tycane3d.com

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THINKINETIC

THE BIRDKEEPER



ARTIST
Tomi Väisänen
SOFTWARE
3ds Max, ZBrush, Corona
Renderer, Photoshop

This image took Ubisoft RedLynx artist Tomi Väisänen just two weeks to complete. "I started working on this image in early July and spent a couple of days just modelling the main character," he explains. "After that I focused on creating a simple kitbash set for all the props scattered around the scene. There are books, candles, etc, you name it."

Initially Väisänen planned to create simulated clothes for his main character, "that turned out to be quite a mess to fit in place," he adds. "As the character sits in a wheelchair, there would be

lots of interaction with the cloth and its surroundings so I just box modelled it. A pretty brute-force approach but it worked fine."

Compositing was the most enjoyable part of the process for Väisänen. "Most of the image is already in place and rendered out so you can focus on smaller details," he explains. "Paintovers and colour adjustments can really make the image pop and shine. It's like a last sprint towards your goal."

● artstation.com/darkki





WOLVERINE



ARTIST
Majid Smiley
SOFTWARE
ZBrush, Maya, Arnold,
UVLayout, Mari, XGen

Freelance character and creature artist Majid Smiley created this ferocious Wolverine fan art while learning to use Arnold and XGen, taking him around two months to complete. “Overall it was a tough yet fun process,” says Smiley. The artist faced his fair share of problems during the project, but was able to overcome them using a healthy mix of internet research and trial and error.

Smiley has no fixed way of getting things off the ground on a project, always favouring the fastest and most efficient way. “I try to embrace new software if it

can help the process,” he adds. Sculpting often marks the starting point of a model, before retopology and UVs. “Once I get those confirmed I move on to the textures and details,” he continues. The basic forms of Wolverine’s trousers were created in Marvelous Designer.

With previous experience in numerous areas of 3D art, Smiley has perfected a pipeline that works across VFX and video games. His inspiration comes from the work of other artists and watching films.

● majidsmiley.com

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**MEDIA MOLECULE'S NEXT PROJECT
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From the outside looking in, you might be fooled into thinking that *Dreams* is just a game. After all, it's exclusive to the PlayStation, you interact with it through a controller, and it won't be too hard to find a gun and shoot something. But *Dreams* is not a game, at least not in the truest sense. Currently available in beta, it is more of a 3D engine, one that sets out to reduce the barriers to entry that so much 3D design software comes with. The intention from the very start was to enable artistry in a very tactile and fluid kind of way that was far

removed from the methods that preceded it. "3D creation is very much an evolution of engineering software that was designed in the early eighties from CAD programs," explains Kareem Ettouney, creative director at *Dreams* developer Media Molecule. "They were targeting industrial and mechanical engineers, and slowly it became for architects and then animators joined the story. As a result, lots of these tools were designed for an engineering process and a way of thinking that doesn't look at all like a sculptor sculpting clay, or a painter painting or a musician playing an instrument like a piano." >



● FEATURE

Made in Dreams



➤ That was the underpinning point about *Dreams*, to move 3D creation away from a technical skill that requires understanding buttons and sliders, instead only requiring that its user have a keen sense of artistry. “The true meaning of art is not the result, it’s actually about the process,” adds Ettouney. “And if the process itself is not therapeutic and expressive, you become a painting-by-numbers kind of person. You become too much of a technician. It’s a very different vibe when you look at Jimi Hendrix and when you look at someone working on one of the characters in a Marvel movie. The origin of *Dreams* was to reset creative tools and make them

Creators are already creating levels and games within *Dreams*, but how far these can be taken – and how innovative they can be – will take time to find out

Modelling within *Dreams* is a case of picking a primitive shape and adding or removing it from the world

liberating, expressive, attractive to watch and yet capable of going to and even deeper than what is already out there.”

Although the engine is currently only in beta, there is already a dedicated and passionate community of creators hard at work in sharing outstanding creations. “I feel that what distinguishes *Dreams* from other 3D programs is a low entry threshold,” says Tomek Mrozinski, a senior 2D artist for Polish games developer Artifex Mundi. “There is not much need for detailed planning of your work pipeline, and [it has a] simple interface. It has also ensured that repetitive

activities are less burdensome, and even pleasant!” As an engine, *Dreams* works on voxels to create its images, having its creators use the motion control built into the PlayStation’s controllers to carve or add to a shape as though it was a piece of clay. It’s more in tune with sculpting than the traditional methods of 3D software, which is something that Mrozinski is able to take advantage of. “I’m a professional artist but 3D isn’t my area of expertise,” he says. “I have some experience working in Blender and other 3D software, but Photoshop is the main tool I use at work. However, I devoted a lot of time in my life to traditional sculpting in clay, wood or even alabaster and these skills are very useful in Media Molecule’s new software.” The fact that Mrozinski can leverage his experience with creating physically to do the same digitally is perhaps testament to the core goal of *Dreams*.

As *Dreams* is running on a games console, the hardware specifications are limited when compared to the rendering powerhouses that most 3D professionals will be used to. While that does limit its potential somewhat, Media Molecule made the decision to move things away from realism and more into the world of impressionism. But even this came with its own set of challenges: “I personally pushed and pushed and pushed to get this impressionistic engine possible,” explains Ettouney, who adds that the voxel-driven base of the engine was achieved reasonably early. “Then we made a lot of breakthroughs in the user interface in creating things through motion capture, being able to capture your hand movements for more natural input. But I was not going to let go of the impressionistic engine; even when they told me that it can’t be done, I didn’t accept it.”

Ettouney tells us of a moment of how Alex Evans, co-founder of Media Molecule, came to him to reveal a “little present” that he had been working on. “Alex had managed to write a concept where he created shapes using a lot of different what we called ‘splats’ and now we call ‘fleks’. I drew him some paint marks and

he used them, in a way, to create a particle system that wraps around the shapes, which we call point cloud, and that gives us those fuzzy impressionistic shapes.” While this was further extended with greater control and the ability to manipulate, it meant that a stylistic charm was brought on by the creations within *Dreams*. As an added bonus, it gave the engine and the experiences created within it a distinctiveness that, arguably, is not available in other 3D engines.

And yet, perhaps one of the most defining aspects of *Dreams* may not even be its suite of creation tools at all. There is certainly a

great breadth of capabilities to the engine, with artists, level designers, musicians and everything in between empowered to create, but in aiming to build a community of creators, Media Molecule has seen sense to bring searchability to the forefront, to allow the creations to be explored endlessly: in-game, this is called Dream Surfing.

“Players using Dream Surfing are used to short experiences and open to unknown,” says Mrozinski, who is all too happy to extol the virtues of the *Dreams* engine. “And so they come across multiple manifestations of experiences difficult to describe. Their scope

“DREAMS HAS ENSURED THAT REPETITIVE ACTIVITIES ARE LESS BURDENSOME, AND EVEN PLEASANT!”

Tomek Mrozinski, senior 2D artist, Artifex Mundi

is really wide. Surf for a moment on the Dreamiverse and you’ll find out for yourself.” Mrozinski points to tutorials that are specific not only to techniques to use within the game, but also more general guidelines that could



Below: It’s possible to go into any other creator’s work and ‘remix’ it – but if anything is used in another’s published work, then the relevant credit is provided





Above: Thanks to the interactive and custom camera and lighting effects, it's possible for complete CG stories to be made

The engine has only been in beta for six months, but already experimentation is showing the variety open to artists

help any budding 3D artist begin to comprehend the complexities of scene setup. But it goes beyond that: a 3D artist's character model could be taken and reworked by an unrelated game designer into their level using a stage created by an environmental artist, all with proper credit being added and informed to all involved. Sharing is at the heart of *Dreams*, meaning that a creator that struggles with one aspect of 3D creation is able to easily find another to help pick up the slack. "I create things that I probably wouldn't do otherwise," says Mrozinski, who together with his wife Joanna is creating a game within *Dreams*. "My wife is often

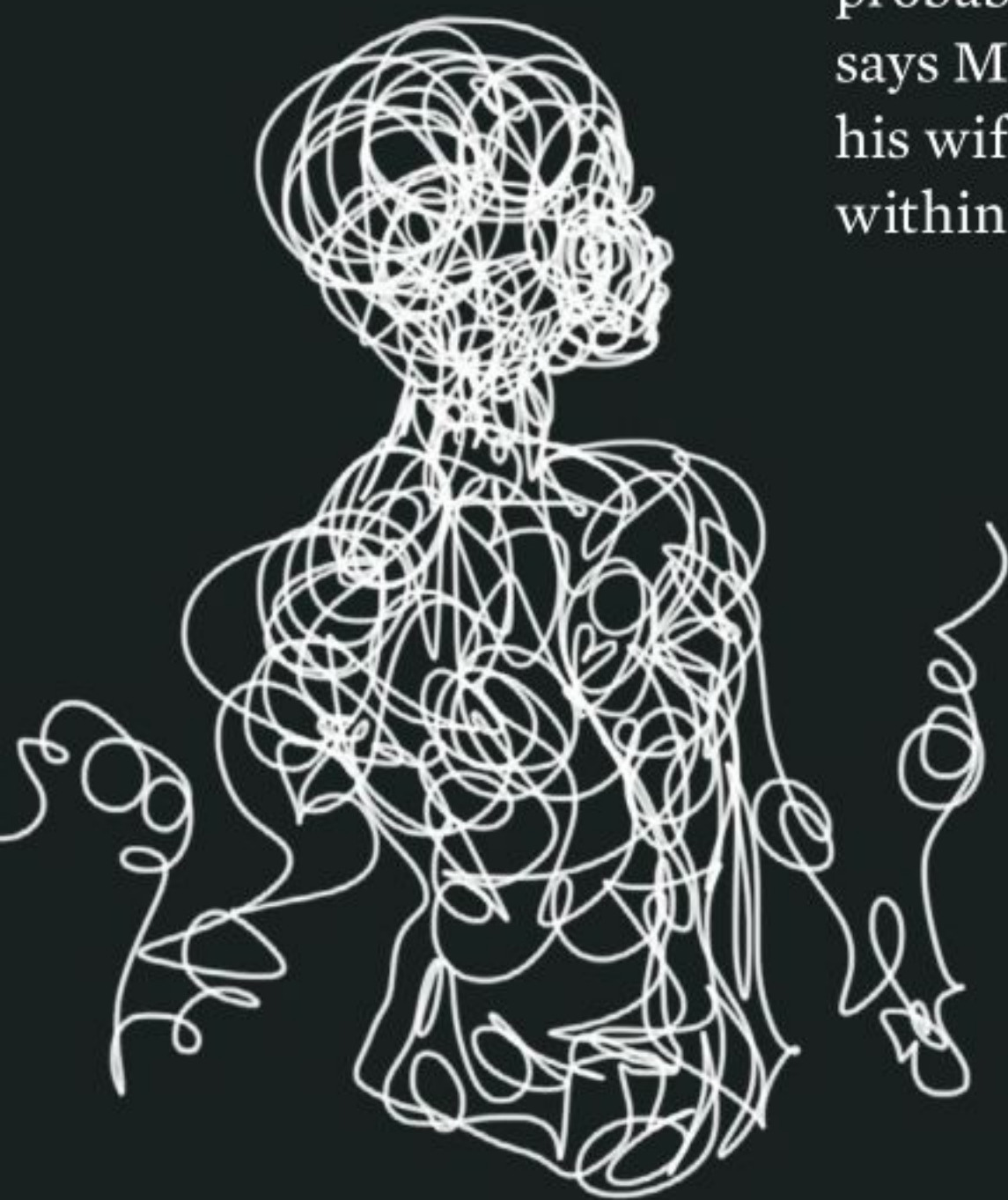
surprised how working in *Dreams* changes my attitude. I specialise in environment art, so character creation is a bigger challenge for me. That is why I tend to avoid this topic in my artwork because I feel that I will have to spend much more time polishing them to the point that I'll be satisfied with the final result. However, when I'm doing it in *Dreams* I'm just jumping into the topic without hesitation. It is also easier to get real-time feedback. My wife Joanna sometimes sits with me on the couch in front of the TV when I create, and gives me her suggestions. The fact that the Dreamiverse is perfect for searching and exploring alternate

possibilities during the process of creating your piece is encouraging and leads to getting fresh results, self-improvement and going out of your comfort zone."

For all its innovation, however, it's hard not to overlook the fact that *Dreams* is a closed-off system, and limited in the eyes of professionals in that sense. Currently there is no way to produce a marketable game through *Dreams*, for example, and while that ensures the creations are all done for artistic reasons and not financial, there is an argument to be made that it can limit the future scope of the engine. "The main thing is that *Dreams* has been in early access for half a year and we are ramping up to keep evolving the project and releasing its first incarnation," says Ettouney. While there are already means to export creations from *Dreams* and even have them 3D printed, this is still limited to an in-house feature within Media Molecule due to the technical constraints.

"THE ORIGIN OF DREAMS WAS TO RESET CREATIVE TOOLS AND MAKE THEM LIBERATING AND EXPRESSIVE"

Kareem Ettouney, creative director, Media Molecule



A DEMON'S DREAM

TOMEK MROZINSKI CREATED THIS TEASER IMAGE FOR THE GAME HE AND HIS WIFE JOANNA ARE CREATING WITHIN DREAMS, CALLED DEMON'S PENANCE...

"It was my second scene made in the *Dreams* Creator Beta, so obviously I encountered some obstacles," says Mrozinski of the artwork. "We wanted to make a piece of art that will give a basic conception about the mood and the plot of our game to the viewer." The idea was to use the style of an acrylic painting, and so Mrozinski began with using brush-like flecks that stopped appearing. "Now I'm aware that there are some limits to the amount of strokes," he adds.

"I decided to create separate thin layers of sculpts and spray a texture over them. All of the parts of the character

are done this way. There are many 3D elements stuck into the picture canvas or floating near it. This helped to speed up things a lot." This was also applied to elements of the scene like the broken glass, lava and fire, which Mrozinski suggests is "more of a relief-like sculpture than a painting."

"In the final steps I added fog gadgets to imitate a bounce light and also strengthen the impression of depth," he explains. "I put some particle emitters to generate fire sparks, and the Grade & Effects gadget was used to bring more contrast and add a vignette."



A teaser for *Demon's Penance*, the adventure game that Mrozinski and his wife are planning to make entirely within *Dreams*

But the team is thinking big, and aware that there is life beyond the confines of the PlayStation. "Everything is in the plans," teases Ettouney of the potential to export *Dreams* files, adding that "this is a live service, it's not a project that releases and two weeks later it's gone." Sony itself has talked about the longevity of *Dreams*, and with the PS5 on the horizon it's perhaps a safe assumption to imagine an improved version of the *Dreams* engine eventually making its way over there, too.

Regardless of what happens, it's clear that Media Molecule isn't looking at this as a game to develop, but rather a haven for artistic expression – it's early days, sure, but the potential is there. "It will keep getting patched and developed and refined with version two and three and so on," adds Ettouney. "This is a project that is meant to live for the next 15 years or more."

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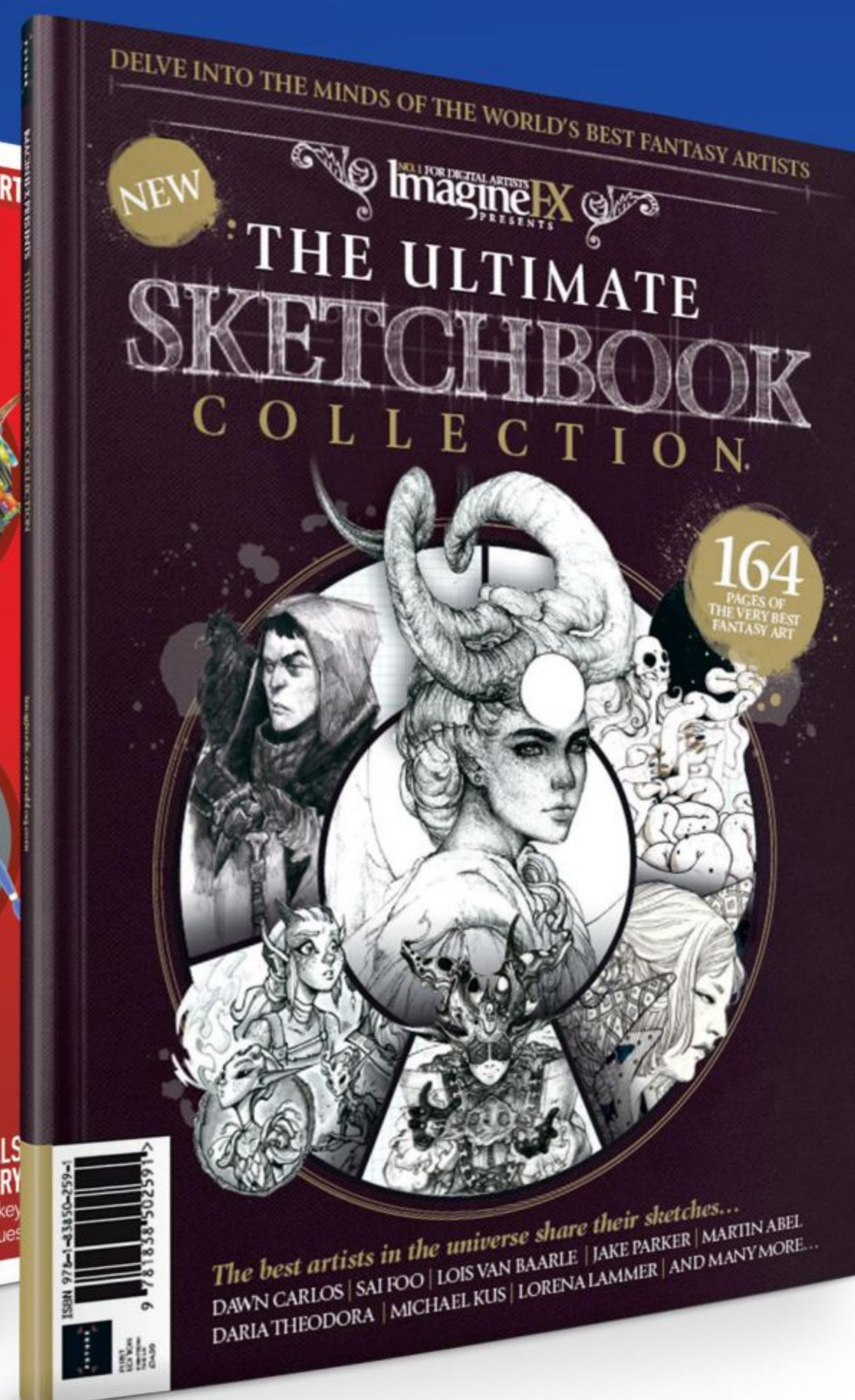
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FUR, SNOW, AND YETI MAGIC

ANIMATING ABOMINABLE

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FEATURE

Animating Abominable

DreamWorks Animation and Pearl Studio's co-production *Abominable*, written and directed by Jill Culton and co-directed by Todd Wilderman, is about the bond between a teenage girl, Yi, and a young yeti she encounters in Shanghai. Together with her friends, Yi helps the creature – which they name Everest – return to its homeland.

For DreamWorks Animation, the film would not only involve creating and animating a large furry CG character, it would also require delivering many instances of magic and several large-scale FX sequences. **3D World** dropped into the studio in Glendale, California to find out how it created *Abominable*'s VFX and animation.

A FURRY YETI

DreamWorks Animation is of course no stranger to furry creatures, but that did not always make the process of crafting Everest any easier, as *Abominable* visual effects supervisor Mark Edwards observes. "Having a 2,000-pound giant furry yeti is a technical challenge in itself, especially with the design we were trying to retain from character designer Nico Marlet. You have to worry about fur stretching, plus the characters are always hugging him, so there's so much interaction."

The fur was handled procedurally with SideFX's Houdini and DreamWorks' own proprietary tools. Interestingly, one of the more challenging aspects of the fur was the amount of 'windy' situations Everest found himself in, where the FX team would have to deal with movement in simulation. "Our head of character effects, Damon Riesberg, was counting the other day all of the different wind that we used," recalls Edwards. "We have helicopters, we have boat wind, we have on-top-of-a-building wind, we have magic wind. Everything was a challenge for CFX (character FX) with all that fur."

"Having a light breeze is actually a lot harder than a helicopter sort of pounding on Everest," adds Edwards. "Because

The first encounter with Everest made significant use of shadow and light to convey the emotion of the scene



with the helicopter, you're like, 'Let's just throw a whole bunch of force and noise, and it's going to feel powerful.' But a more subtle wind effect can make the fur seem too underwater and swimmer-ly."

ANIMATING EVEREST

The design for Everest had him, at times, as almost like a large white ball. That was something DreamWorks' animators – numbering more than 50 for the film – had to ensure remained part of the character's silhouette as much as possible. They also had to imbue a distinctive personality into the yeti.

"A big thing was that Everest is not old, he's a kid," remarks head of character animation John Hill. "And so we had to ask, how do we incorporate that into his character? How can we portray that in the movement? And then just because of his design, he looks like he would move like a gorilla, but we wanted to not take the easy road. So we came up with a >



“EVEREST IS A KID, SO WE
HAD TO ASK, HOW DO WE
INCORPORATE THAT INTO
HIS CHARACTER?”

John Hill, head of character animation



DREAM TOOLS

A COLLECTION OF PROPRIETARY TOOLS FOR ANIMATION, EFFECTS AND RENDERING HELPED BRING ABOMINABLE TO LIFE

PREMO

For many years – essentially since *Antz* – DreamWorks Animation had used its Emo spreadsheet-like animation software. This changed on the second *How To Train Your Dragon* film, with a move to the more GUI-like Premo system, which was used on *Abominable*. “The huge turning point when this came online was real-time feedback,” says head of character animation John Hill. “Things just got so much quicker and we got feedback earlier from the program, and it allowed us to make more mistakes earlier.”

MOONRAY

MoonRay is DreamWorks Animation’s physically based ray tracer render engine, replacing their previous lighting and rendering tool called Moonlight. “When we started using MoonRay here,” says visual effects supervisor Mark Edwards, “it was a game changer for us in that the geometric complexity that you could throw at it and the speed that it could turn things around was incredible, even just interactively for artist iterations. It’s phenomenal.”

SPRINKLES

“One of the things we’ve done a lot more in *Abominable* is make our environments really rich with our scattering tool called Sprinkles,” outlines Edwards. “It lets you paint set dressing in a really interactive way. You can art direct, you can build different brushes, you can do all these different things. It enabled us to take our sets and add leaves and grass. We call it micro-dressing, in terms of pebbles and rocks and just things to make the ground play not flat.”

ARRAS

Arras is DreamWorks Animation’s cloud-based framework used to distribute rendering tasks to a cluster or cloud. “It effectively lets us use other machines to drive the render,” says Edwards. “It’s really handy to be able to say, ‘Hey, I’m going to offload off my machine because I’m running three different new comps, but I want to render this in the background.’ It also allows MoonRay to take advantage of massive machine scale distributed rendering. And that, again, lets you get turnaround for artists much faster.”





› combination of animals that he is like, because we didn't want him to only move like an orangutan or only be like a cat, or just come up with some weird way that he would move."

A curious puppy was one reference point for when Everest gets excited, while a large panda was the go-to for more quiet moments. "Early on, too," says Hill, "we did try moving him around like a biped, and it just looked like a guy in a suit, which we desperately did not want."

Hill adds that one particular aspect of Everest's character that he and the animators were fond of in the design was that the yeti only makes throat sounds and humming; he does not speak. "Which, as animators, that's what we love. That huge challenge of a non-speaking character that has to communicate something. There's so many sequences in

"SO MUCH COULD BE SAID WITH A WELL-TIMED BLINK, OR JUST A SLIGHT TILT OF THE HEAD"

John Hill, head of character animation

Yi is able to communicate and draw Everest the yeti's powers out with her violin

Everest's large face and eyes helped with bringing out his emotions for the animators

the movie where there's so little dialogue that's spoken, even from the kids themselves. We just used expressions, or relied on what Yi is doing, how she plays the violin, how Everest listens. All that stuff was just such a wonderful, daunting, scary challenge."

Of course, much of Everest's personality came from animating the creature's face. Luckily, his face is huge and his eyes wide, which gave DreamWorks plenty of movement to deal with, especially on Everest's brow. Still, it had to remain subtle, at times. "We found that if we got too complicated by trying to do some of what humans

do with their brows, all those intricate shapes, that it just wasn't coming across on the screen," reveals Hill.

"With his brow shapes, less was more. Plus he has all that hair up there. So we're pushing those hairs around and compressing them and expanding them. You just have all these hairs moving around and you want to have this emotional moment on the screen, so we had to pull back from that."

As noted, the fact that Everest doesn't speak was welcomed by the animators, but also proved challenging to communicate personality. Says Hill: "So much



could be said with a well-timed blink, or just a slight tilt of the head, or from our library of Everest sounds, where he didn't say anything, but maybe he just makes a sound and a head tilt, and so much is conveyed. I feel that since he doesn't say anything, it draws the audience in, and they put themselves in that moment from their own experiences, and they go, 'Oh, he must be feeling this'."

In general, DreamWorks animators would work with a rig inside the studio's Premo animation software that was more of a greyscaled version without Everest's hair, but they could 'turn on' various generations of the hair during animation. "It was sometimes only hair-like geometry that didn't deform, but generally kept the silhouette we were wanting to go for," explains Hill.

However, one kind of animation rig available did have a high

number of hairs on the model and rig to see in the animation software. These were like 'spaghetti strands', says Hill. "It let us see what the fur behaviour could be, say if Everest was moving really fast, we'd then know we had to do a certain thing underneath the hood to make sure the hair didn't freak out too much."

RIDING THE CANOLA WAVE

At one point, Everest, Yi and the other heroes are escaping the clutches of the film's villains. Everest uses his magic to power a boat they are on along a river and into a canola field. This field turns into massive waves of flowers, and the boat surfs them to safety.

"For that scene," explains Edwards, "we had a picture of it in our minds, but we had to work out how it was going to feel interacting with our characters. And then you have billions and

billions of flowers that you also have to just simulate and render and instance and deal with."

The process began with storyboards, concept art and early previs and layout – all of which drew on some original reference of people wakeboarding in a cranberry bog. "It was basically red cranberries floating in water, but the wake looked very different and we wanted a similar kind of trail with the flowers," details Edwards.

FX and previs combined early to nut out the look, since effects simulations would be driving a lot of the action. Animation then provided some base movement for the boat and wave. Says Hill: "We had some early task force meetings where we said, 'Okay, well what do we need to just get going?' Well, we needed the boat, we needed some rough geometry for the wave, just some kind of surface, and then we could get the cameras positioned and the motion of the boat."

The FX teams then handled the flowers and water-like effects simulation via instancing in Houdini and with DreamWorks' proprietary renderer MoonRay. "There's the main wave," outlines Edwards, "and then we had spray and flowers and all of the extra bending of the boat going through them. There was also a volumetric pollen cloud that travelled with it."

FISH IN THE CLOUDS

Along with the canola wave, there are plenty of other effects-heavy sequences, including an encounter Everest has on a snow-covered bridge with the film's villains. Another is a scene which sees the heroes ride clouds above the mountains that resemble koi fish. The scene would require another unique combination between the animation and FX teams. >

The film's landmark FX sequence sees Everest pilot a boat through a large canola field

Character interaction with Everest's fur was one of DreamWorks Animation's biggest challenges



MAKING WAVES

STEP-BY-STEP ON DREAMWORKS ANIMATION'S APPROACH TO THE CANOLA WAVE SEQUENCE

1 CONCEPT

A concept painting for the canola wave. The idea was that Everest's magic would convert the field into a fluid-y formation.

2 COLOUR KEY

A colour key is produced to provide a very clear sense of what the final shots should look like, both in terms of the colour and composition.

3 WAVE GENERATION

The FX department then developed an underlying fluid simulation that would inform the final appearance of the flowers in wave form.

4 QUILTING

Since the surface of the wave would be covered in canola flowers that needed to bunch up in specific ways, artists developed a quilting pattern.

5 FOAM

Just like a real wave, a 'foam' look was achieved using the flowers and stalks themselves to give an impression that the characters were surfing for real.

➤ "The filmmakers said, 'We want them riding on these big koi fish made of clouds,' and we were like, 'Wait, what?'" says Edwards. It's hard to have a white character on a white cloud on other white clouds going to a white mountain! So we really had to figure out a lot of things."

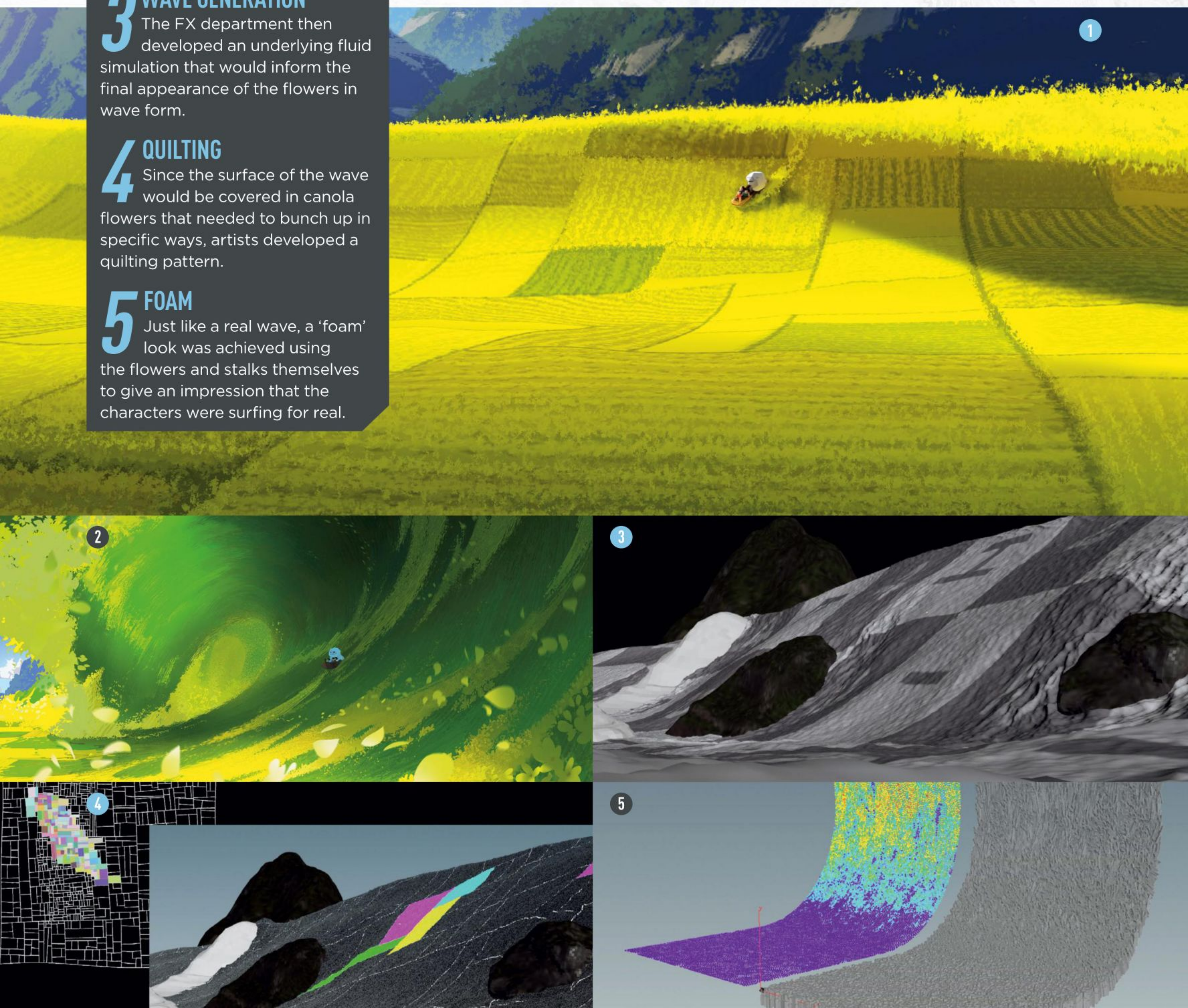
Koi fish have particular markings that, in cloud form, were initially somewhat lost. But artists were able to rely on lighting cues to ensure that both the fish outline and the markings remained present. DreamWorks Animation has, over the past several years, invested heavily in cloud simulations, relying on volumetric simulations and OpenVDB to produce cloud effects. That approach worked here, too.

As exploration on the sequence began, so too did a previs process. Usually previs

only relies on basic shapes for animation, but here the team wanted to ensure the fluffy clouds aspect of the shots were being communicated. "Our director Jill was very aware that when they were riding random fish in the sky it could look really cheesy," says Edwards. "But it was supposed to be a magical, breathtaking moment. So in previs, we actually enabled the volume of the clouds to come through."

"We learned a lot here," adds Edwards. "Sometimes it would look too smokey, or it would trail too long. Sometimes it would break up the silhouette too much. What worked well was keeping all the crispiness, and also the light coming from the middle of the koi cloud, which let us keep that koi pattern in."

FYI Find out more at dreamworks.com/movies/abominable



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BUSINESS MODELS \$\$\$

Experts share their thoughts on the industry and give tips on how to sell models successfully using TurboSquid's online marketplace



For almost two decades TurboSquid has sold stock 3D models to be used across a host of different industries and mediums, including everything from filmmaking

to video games and architecture. With stock models becoming an increasingly prevalent part of the industry, **3D World** has assembled the ultimate guide to successfully selling your models online on TurboSquid.



SELL YOUR 3D ASSETS

A selection of TurboSquid's most successful artists share their advice on creating quality models

What sets TurboSquid apart from other online 3D model marketplaces?

"Since I joined in 2011 they have introduced the CheckMate program, StemCell, PixelSquid, and their Complete Confidence guarantee. There is a sense of professionalism with TurboSquid and they have the best support. I get to spend more time modelling and not having to deal with customer support. They handle it all." *Wes Abrams*

"TurboSquid's publishing process is uncomplicated. I can have a product online and ready for sale minutes after uploading. Also, the product page allows you to showcase the model through HD images, turntables, and downloadable promotional files." *Denys Almaral*

Are there any skills or capabilities that artists should have before selling models on TurboSquid?

"A seller should be able to produce CheckMate Pro-quality assets, since the competition is becoming really tough. Model quality is rising and to be successful you need to continuously improve your skills. You need to have the ability to train and organise yourself. Do market research on your model. Once you've decided what to create, try to find your own way to show the model, so that it can stand out from the others." *Massimo Righi*

How can artists be successful when selling their models on TurboSquid?

"Produce clean and organised scenes. Focus on usability and an error-free product. TurboSquid's CheckMate program is a good guide to follow. I believe it's better to offer a modest medium-

complexity 3D model that can be useful and is perfectly clean, easy to work with, and easy to convert to other formats, rather than uploading a very complex and visually stunning model that a buyer can't correctly and quickly work with because of missing plugins, unnecessary high polygon counts and a disorganised scene."

Denys Almaral

"Try to specialise and find your niche. Keep learning and improving your skills and try to find a way to get recognised. Build your own style in a model's presentation and rendering, try to differentiate and avoid copying other artists. It's not easy but with passion and work, it can be achieved." *Massimo Righi*

What are the benefits of using stock 3D models?

"Stock 3D models can solve an immediate problem in projects where 3D modelling isn't worth the time. To meet deadlines, often time has to be allocated to more important and critical aspects of the project and that's where stock 3D models can be a life saver. They can be employed to quickly decorate a scene or they could be used as a base and starting point. There are countless use cases and with the growth of real-time applications and VR, demand for such content is growing every day."

Ashkan Ghaffari



3D Earth simplified concept in low-poly style by Denys Almaral



EHang DHL Express Drone by Ashkan Ghaffari, Henry Lazaga

TOP STOCK



TurboSquid's vice president of production, **Mark Dunn**, talks the world of stock models

What advice can you give artists who want to be successful selling models?

Put yourself in your customer's shoes. It's critical that you consider what it is like for someone to review your model before making a purchase. You need to include lots of detailed renders, shots of wireframes, turntables, maybe even real-time preview versions of your model. Include clearly written descriptions and accurate metadata info so that there is no confusion. Having a great model is only part of the solution – you have to present it in an effective way to make sales.

Are purchasing trends changing?

We're seeing that customers are much more open about the idea of using stock content. 10 or 15 years ago you'd run into a lot more people that wanted to do everything themselves. Now, artists are more likely to recognise that they don't need to rebuild that same red barrel again for the 25th time. We're also continuing to see free apps like Blender gain in popularity, as well as increased demand for newer formats like glTF and USDZ.

What are customers asking for? What does the library still need?

Customers want high-quality content that just works. They don't want to have to struggle with poorly built content. They

“THE KEY IS FINDING A NICHE WHERE YOU CAN PROVIDE UNIQUE VALUE”

Mark Dunn, vice president of production, TurboSquid

want something that is going to make their lives easier, which is one of the reasons we worked with industry leaders to create the CheckMate and StemCell standards. The US has also traditionally been our largest market, but we've seen significant growth in countries all over the world. Products and styles are different around the globe – electronics, cars, furniture, clothing, street signs etc – so looking for popular objects from

Far right:
TurboSquid model
for Conocybe Filaris
mushrooms, created
for the *Morels: The
Hunt* video game
© Wes Abrams

Above: In-game use
of Conocybe Filaris
mushrooms
© Wes Abrams

Below: Cartoon
stylised Siamese
young cat by
Denys Almaral



different countries is a great way to target customers outside of the US.

How has the rise of PBR changed professional modelling?

It's made it easier for artists selling stock content to build models that will appeal to a broader customer base. However, since different 3D and real-time apps still tend to present variations on how PBR maps are named and composed, standardisation is still a little down the road. There are also no standards for things like WebGL renders, so the same model can look pretty different depending on which viewer you use. That's why Khronos' 3D Commerce Working Group is so important right now. Together with 70 other major companies, TurboSquid is helping to build those standards so PBR output becomes more predictable.

How have VR and AR affected the 3D model market?

It has certainly brought more customers into the market for stock



Uber Flying Taxi – Bell Nexus Drone by Ashkan Ghaffari, Jonivan Carter, Henry Lazaga





3D, but it's also increased the needs for standardisation. The barriers to entry in creating a VR/AR game or application are so low now, with free versions of many amazing content creation tools available. With this, we've seen a rise in non-traditional customers whose 3D experience might be minimal at best. Stock artists who understand this and spend time making sure that their content works for as many customers as possible will have an edge.

Are there steps artists can take to future-proof their assets for potential customers?

We encourage artists to create content using the StemCell specification. With StemCell content, artists create the content once – then TurboSquid automatically generates multiple format conversions and packages those assets for partners and new uses (real-time engines, AR/VR, etc), creating additional revenue for the artist. Another way to extend

the lifespan of an asset is to revisit old models and update them to newer renderers.

In terms of models, does detail matter and to what degree? Should artists be working with 2K textures? 4K? Something higher?

More detail and larger textures are usually the right way to go, as long as the model is still flexible. A customer can downsize the textures if they need to, but providing them the option of 4K textures is plus. If a model has good topology and edge loops, a customer can also simplify the mesh if they want to.

However, knowing when to be efficient is important. For example, a lot of small surface details can be handled by a Normal map instead of being modelled. 4K is the highest we would recommend right now.

What are the most popular model types in TurboSquid?

There's a massive amount of variety in what sells. Certain

categories like vehicles, characters, electronics, trees and architectural elements have always been huge sellers. The key is finding a niche where you can provide some unique value. That could be a version of a popular object in a format no one else has done, or maybe including rigged versions of your models.

Below: Massimo Righi's 4K tiger rendering was originally created for a print project before becoming a TurboSquid asset



WORK WITH STEMCELL

TurboSquid deliver a six-step guide to using their standardisation tool, StemCell, for creating versatile models



In 2017, TurboSquid developed an automated conversion process for artists called StemCell; the idea was to make it easier for artists to focus on doing what they love – making new models – without having to remake them for every major 3D application or renderer. With StemCell, artists make one model and it will work with 3ds Max, Maya, Cinema 4D, V-Ray, Arnold, Unreal, Unity and more.

And while the StemCell tools were built for TurboSquid artists, the idea behind the process can work for any artist. When you build your models following these principles, all of which are based

around a PBR workflow, you can ensure that your models will be as versatile as possible.

Tools and software

The great thing about building portable PBR-based content is that you can work with almost any modelling tool. The key to content portability is texture-based materials, so you'll need a texture painting program like Substance (our favourite) to get the job done.

Clean geometry

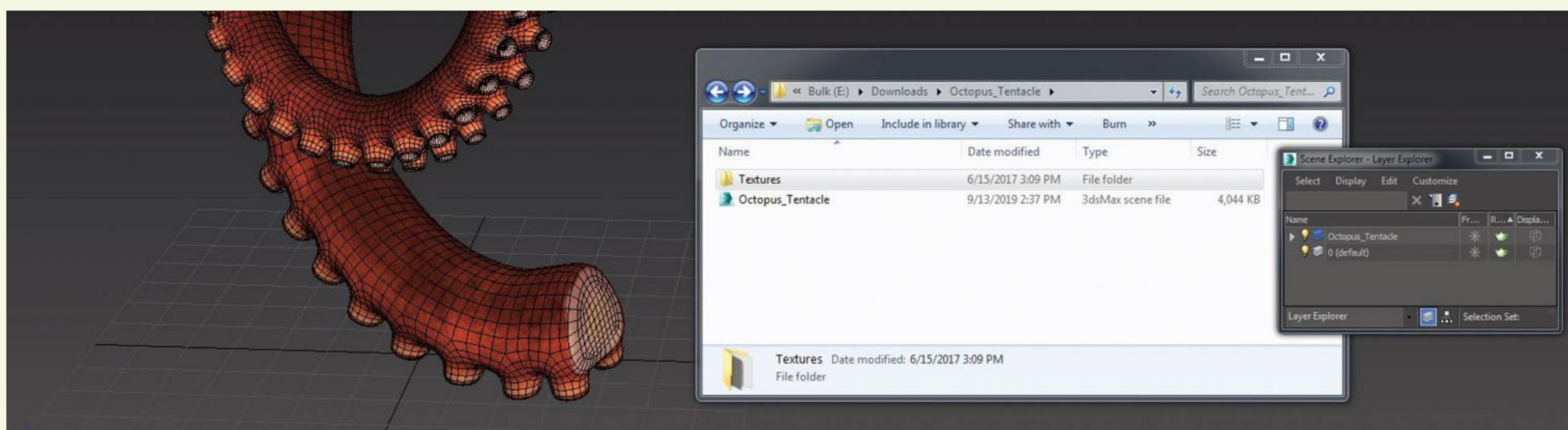
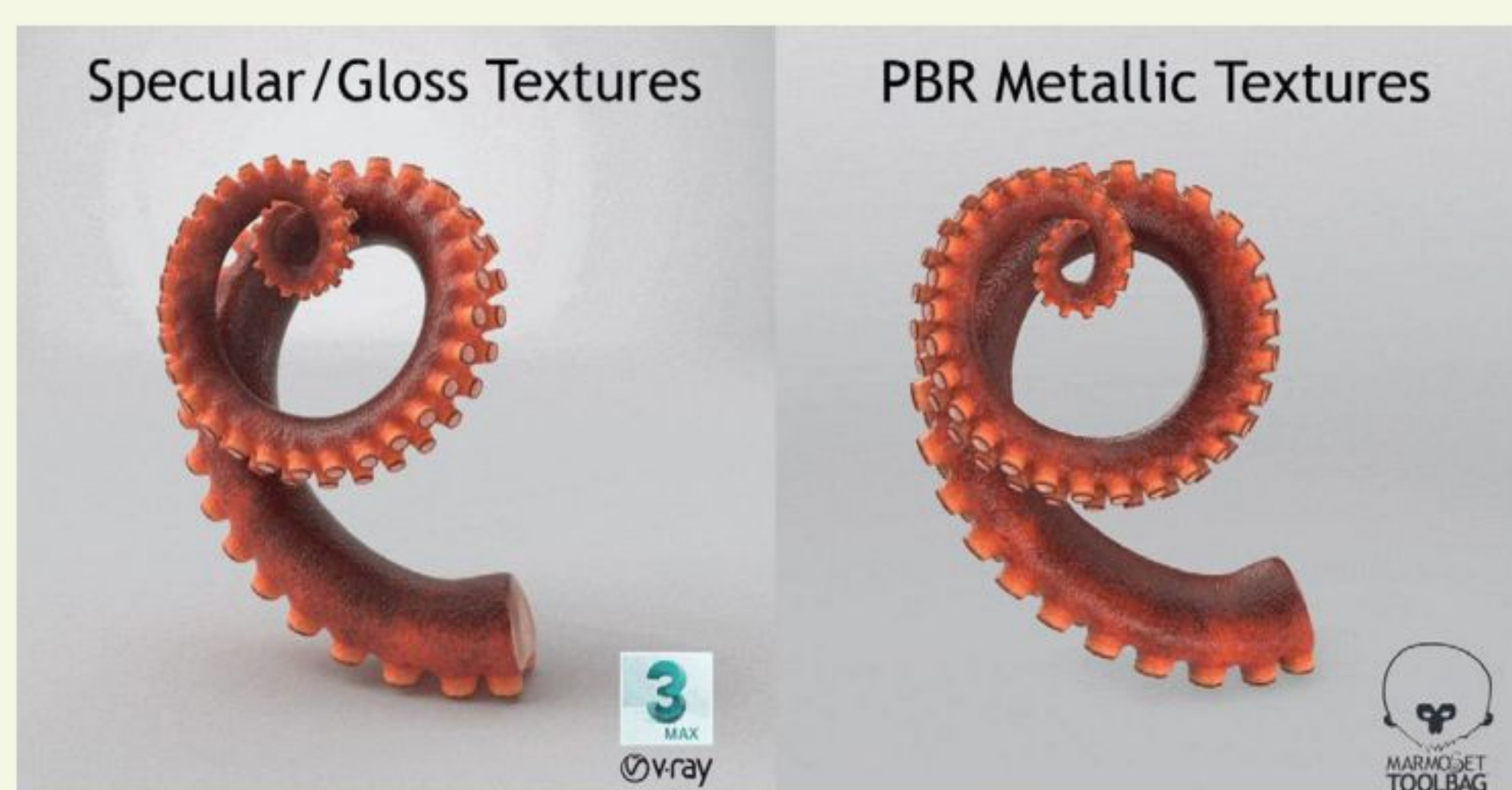
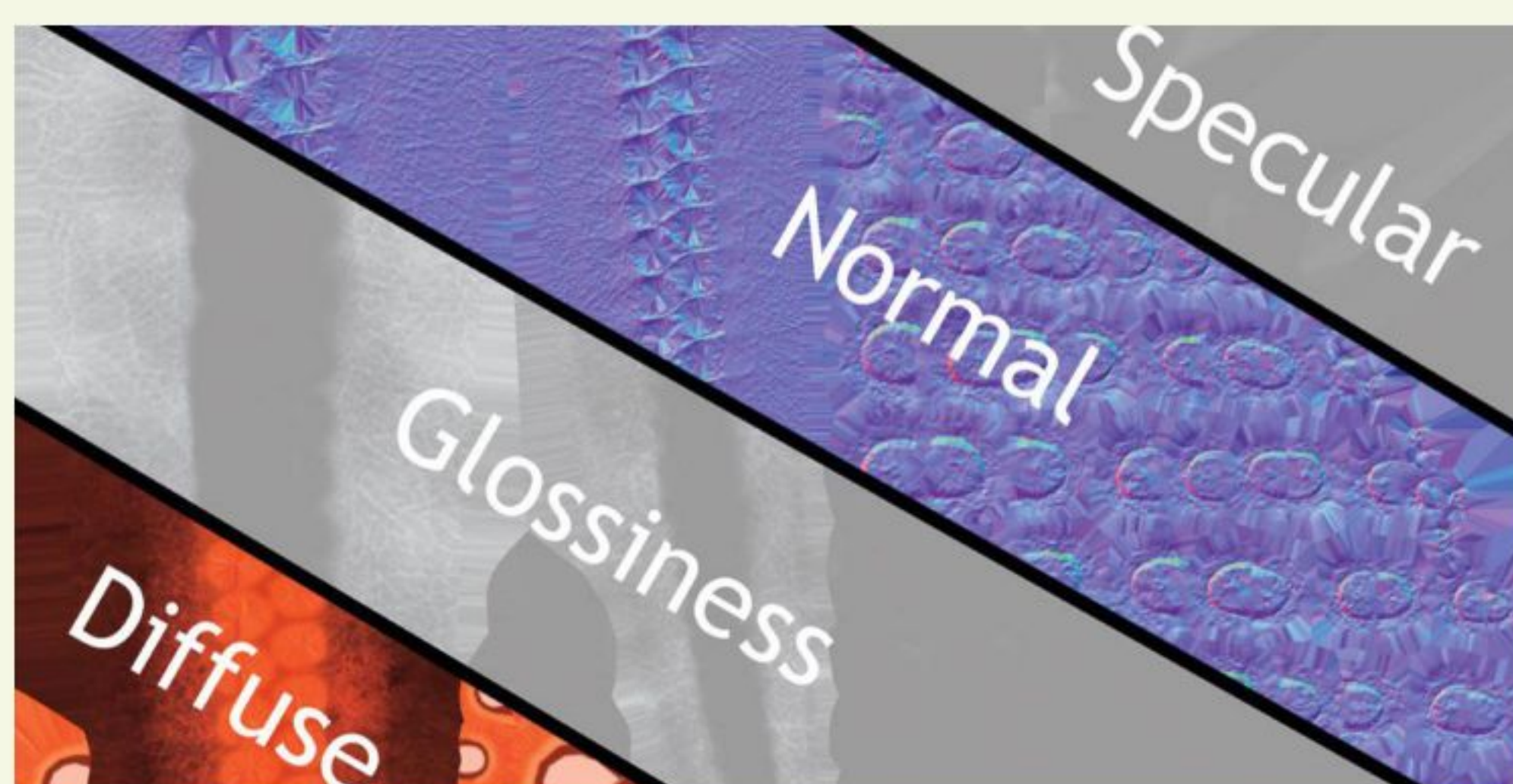
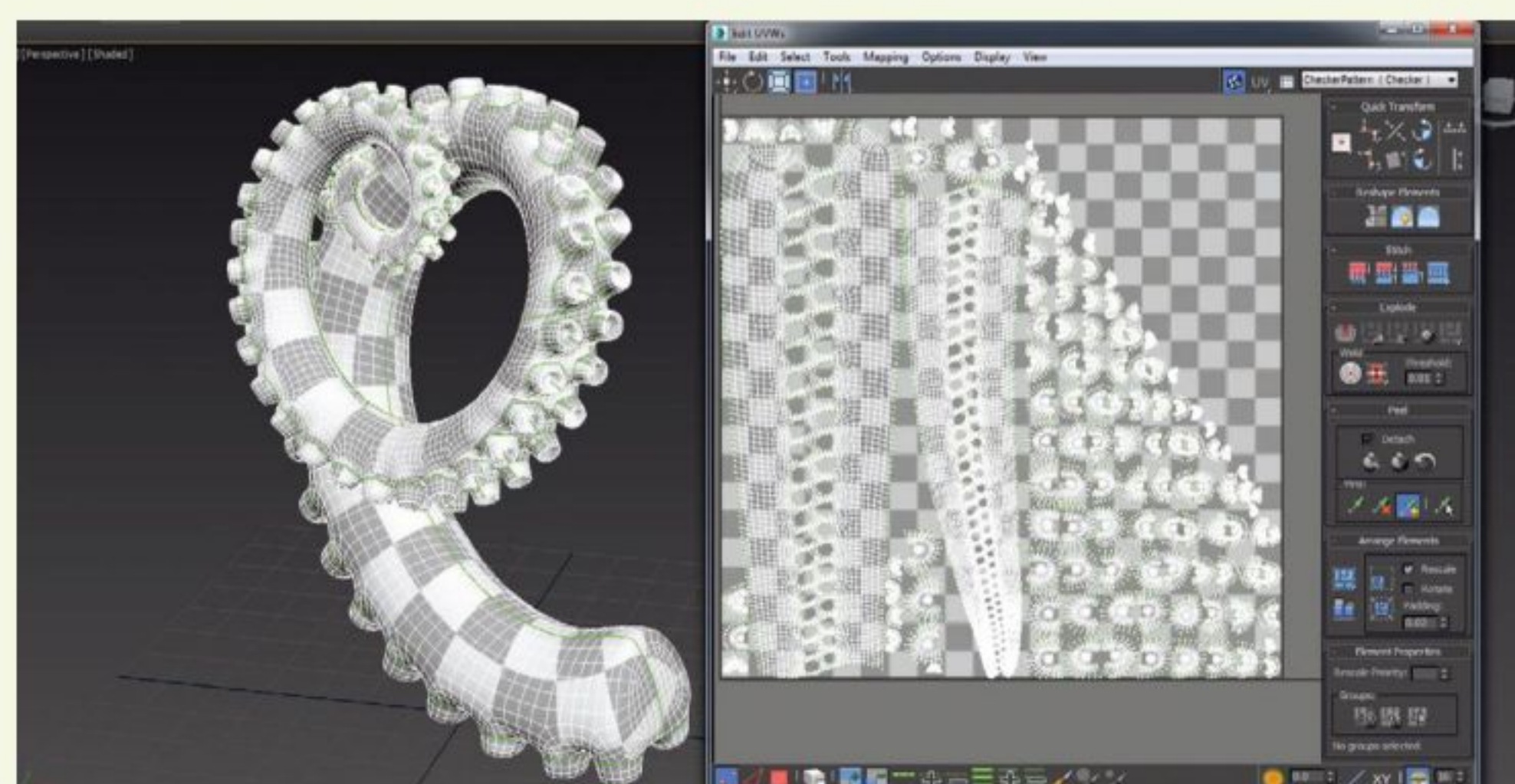
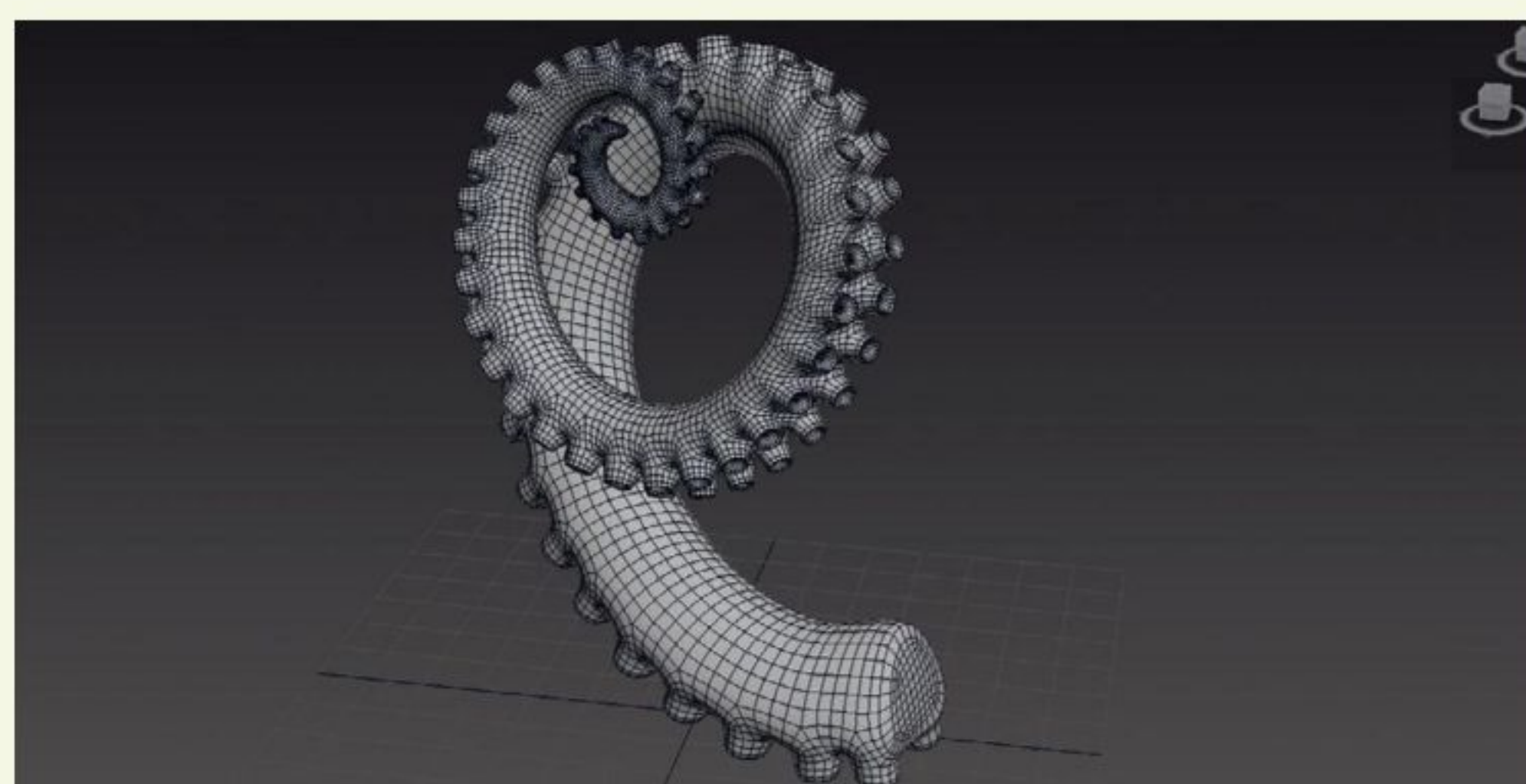
If you're selling stock content, an easily editable mesh is important. For StemCell, we focus on quad-based modelling, holding edges to support smoothing, proper edge

StemCell allows artists to upload models and receive perfect conversions for 12 major formats and applications

flow, and an emphasis on efficient use of the number of polygons. The customer should be able to easily update any model for whatever project they are working on.

Unwrapped UVs

StemCell relies solely on textures for material values, and the only way to assign a texture to a model is by having some type of UV mapping assigned to the mesh. Since the majority of TurboSquid customers are buying models to save time, an unwrapped model immediately becomes the most attractive option. One thing to keep in mind: your UV maps should be normalised across objects or parts in a scene. This is most often



checked by using a checker pattern for consistent size across the entire object or model.

Texture-based materials

PBR workflows (StemCell included) require a purely texture-based workflow, no procedural textures allowed! Instead of complicated material setups, PBR allows an artist to create a few simple maps and still achieve extreme photorealistic renders. Using a real-time previewing tool like Marmoset Toolbag is a great way to quickly review your textures.

Spec/Gloss and PBR Metallic

StemCell is compatible with both 3D creation apps and real-time apps

Some of the biggest companies in the 3D industry are helping to shape StemCell through the StemCell Industry Council

(Unity, Unreal). In order to convert into native files for all of these programs, you just need to process your textures so they include both Specular/Gloss textures and PBR Metal/Rough textures. While you can create these textures manually in any photo-editing software, you can also automatically generate all of the maps using Substance Painter. Using Substance Painter also allows you to paint and edit your textures extremely easily, which can save a lot of time compared to manually painting.

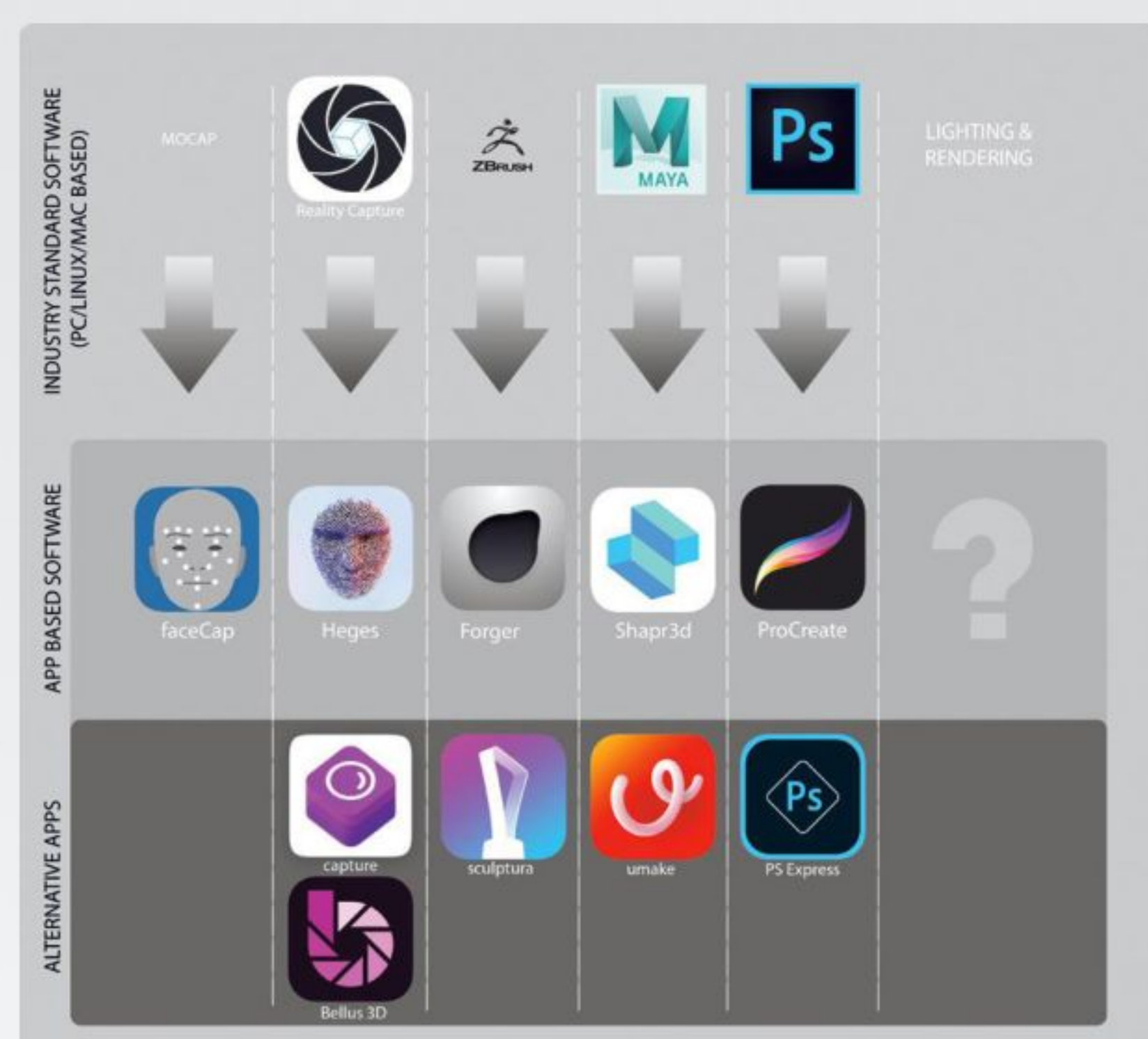
Saving and converting

Once you've completed your model following these guidelines, you will need to clean up the

files so everything is organised, neat, and easy to understand for the customer. This means you've ensured all of your model components are named, you've deleted any construction elements (nulls, curves, etc) that are no longer required, you've put all of the geometry into a single layer (named appropriately), centred the model at the origin, and more. Delete any lights and cameras you may have added to ensure that your submission only contains the model itself. If you're a TurboSquid Artist, you can submit your model for StemCell Certification and the model is automatically converted with render test frames in each piece of software.

HOW LIGHT CAN YOUR MOBILE STUDIO BE?

Is it possible to have an entire 3D studio on something as simple as an iPad? Adam Dewhirst explores how apps are pushing boundaries that were once uncrossable



How PC/iPad software compares

The holy grail as a freelance artist has always been the ability to work remotely on as light and simple a device as possible. It's simple logistics: the smaller your device, the less gear you carry, the more accessible you make yourself – and the more likely you are to be hired. Wouldn't it be great if everything you needed fit into a backpack and was all contained on one device? No peripherals, no extra cables for ports you didn't expect, no hard drives – just one device that could do everything.

That day may be sooner than you think – and possibly not on the device you would imagine. Conventional thinking would be to explore something like the Wacom MobileStudio, a device that sets out to do just this – give you the full operating power of a PC contained in a single mobile device. However, with a price tag of around £1,500 for the 2016 model, and £3,199 for

the latest, the majority of people may be put off. Combined with the cost of full software licenses, you would be forgiven for possibly choosing an alternative path.

One such path is proving to be quite interesting: the iPad Pro. The latest iPad Pro starts at only £769, making it much more affordable, but can it compete with the processing power of a Wacom? The answer is sadly no, however, that could be less of a stumbling block as it may not require all that raw power anymore to complete the same tasks. Recently, developments from Apple are allowing much more complex programs such as Shapr3D and Forger to really shine with the use of an Apple Pencil. Combined with its generally user-friendly interface, portability and ease of sharing files, the iPad Pro has become a real option for basic remote 3D work.

Here is the challenge we'll explore – how much of a full 3D pipeline can you realistically





➤ recreate using apps on the iPad Pro? For this task we are going to take a look at the following apps:



Forger

£9.99 (optional texture upgrade £0.99)

In this case we are using Forger in place of ZBrush/Mudbox. It's a sculpting app developed by Javier Edo, an R&D developer at Passion Pictures. Forger is actually quite old, but it's had an interface update, and with the release of the iPad Pro it seems to be undergoing a new lease of life, with the upgraded processing power really making this an incredibly useful tool.



Shapr3D

Free (for up to two files), then full year licence \$240

Don't be put off by the price, Shapr3D is a super powerful and very versatile tool. We are going to be testing this out as our 3D modeller, in place of Maya/3ds Max/Blender/Modo. It's similar in workflow to a CAD modeller like Moi 3D.



Procreate

£9.99

Procreate is Apple's flagship drawing app. We are going to be using this as a digital illustration tool, essentially in place of Photoshop or Corel Painter. It's super attuned to the gesture-based functions of the iPad and Apple Pencil and has a lot hidden under the hood.



Photoshop Express

Free

This is a stripped-down version of Photoshop. We'll see what it can do, but it may soon be replaced by a greater offering from Adobe.

FIRST UP, LET'S TALK ABOUT WHAT'S MISSING

Rendering, animation, rigging – so straight off the bat, we are limited to the asset creation portion of the pipeline; we can model, and create artwork/concepts, but that's where this journey ends.

...Almost. There is surprisingly some limited capability for mocap. Apps like Face Cap allow you to use Apple's front-facing camera as a motion capture device, allowing

Below: With the right apps, an iPad gives you the power to develop your ideas on the go, allowing artists to spend even more time creating

Bottom: Side camera and perspective view in Shapr3D

you to record basic speech and facial expressions.

WHAT'S IN THE PIPELINE?

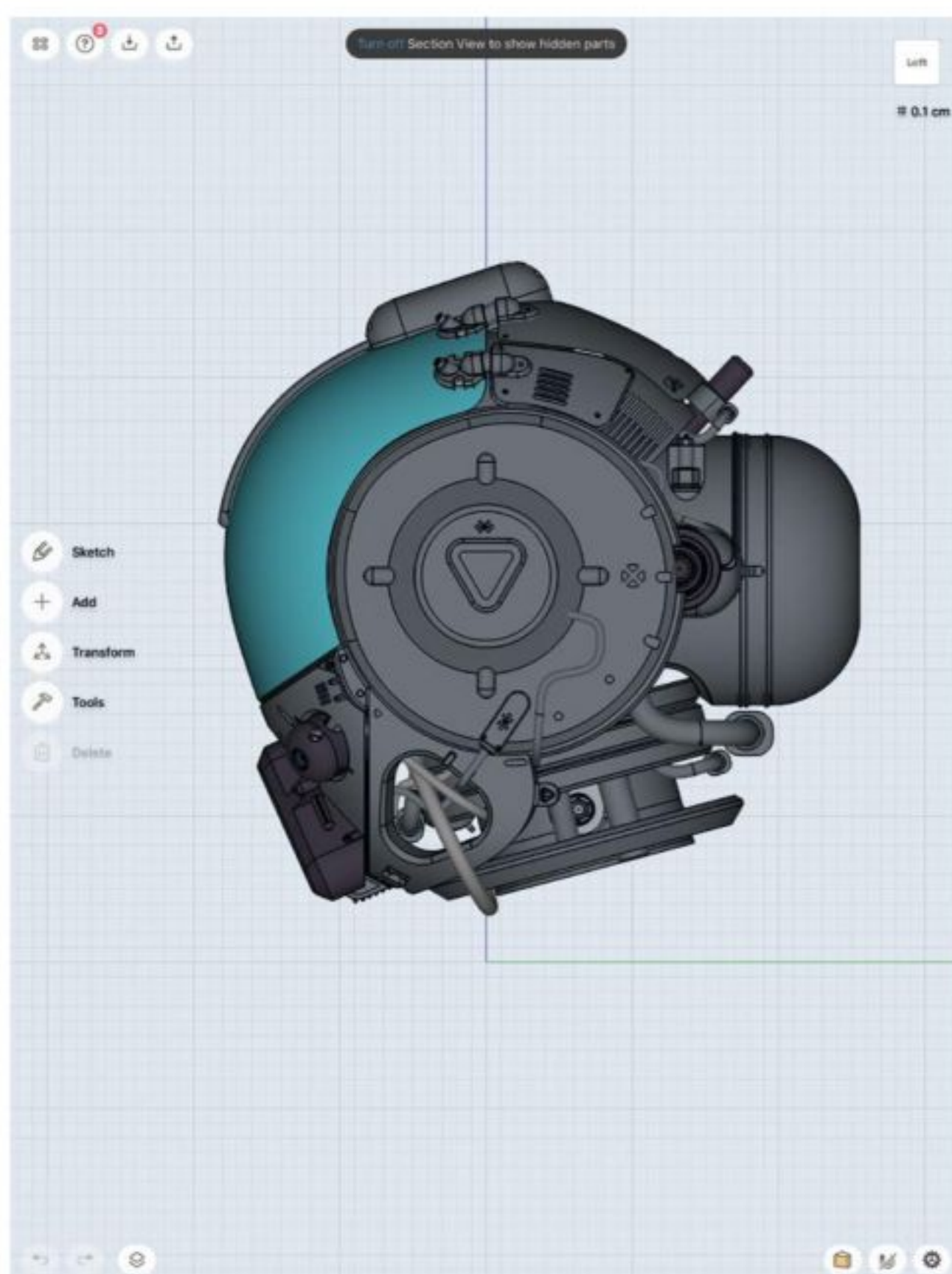
I'm hesitant to give PS Express a full review, as it seems like a placeholder, considering the long-standing rumour that Adobe will be releasing a full version of Photoshop CC for the iPad Pro in 2019. Screenshots of the interface are already available with the beta testing group open since May – this should hopefully appear sometime before the end of the year (fingers crossed). The implications of a

full-blown release of software available as an app are staggering, potentially paving the way for artists new to the industry to start out on something as simple as an iPad, without the expense of a graphics tablet.

WHAT IS POSSIBLE?

Asset creation is where these apps shine. Forger is a solid substitute for ZBrush, in fact in many cases it exceeds it – not in its overall power or scope of tools and abilities, but certainly in its interface. It's designed specifically for the iPad,

“SHAPR3D IS A FAST AND EFFICIENT TOOL, ABLE TO PRODUCE COMPLEX GEO IN MERE MINUTES”



CLEAN UP IN ZBRUSH AND KEYSHOT

THE BENEFITS OF COMBINING TOOLS

Although it would be great to be able to do the entirety of this process on the iPad, there is a benefit to knowing when to admit defeat, and the truth is that cleaning up scans is much easier in ZBrush, and it's super fast to then render these creations in KeyShot. Combining the Heges app with these two powerhouses is a great workflow.



Facial expressions
taken from Heges

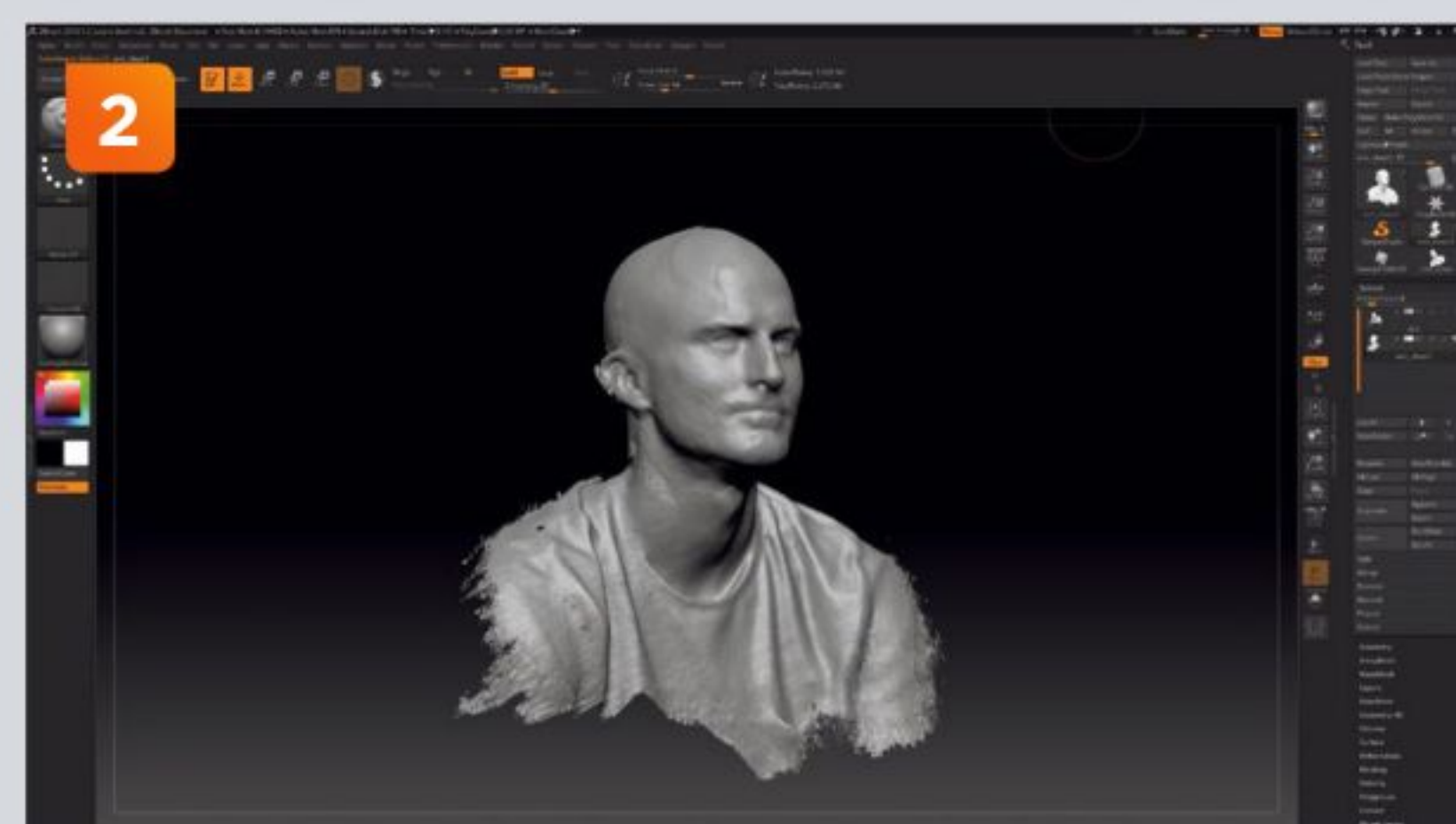
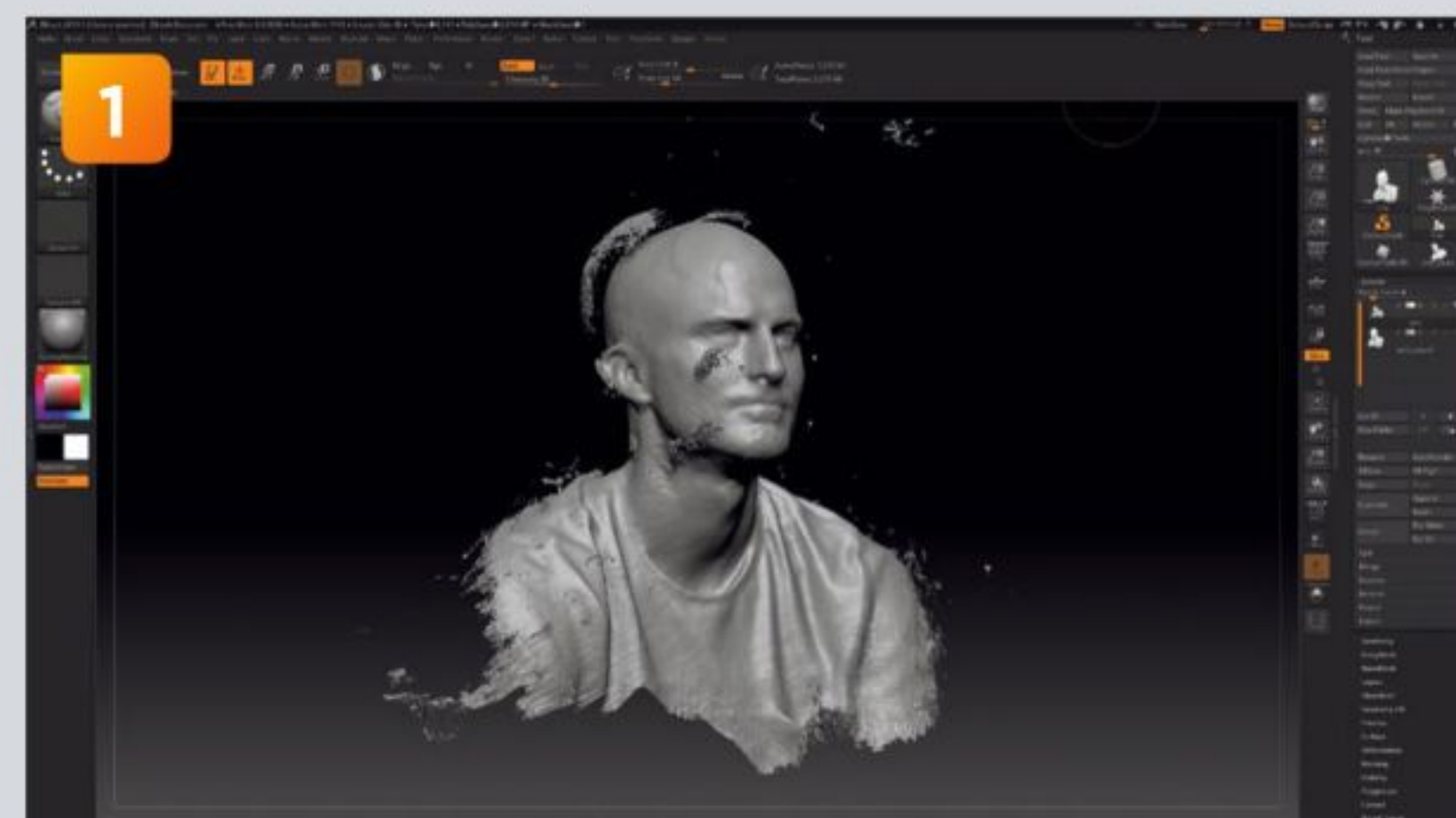
and so the layout of tools is neatly arranged for you to use your right hand to draw and your left hand for alt keys like the smooth and inverse functions. One of the things I've struggled with using ZBrush on mobile devices is its navigation, as you really need to make a custom interface to make it functional on any tablet, with many people resorting to buying Wacom's ExpressKey tool to make ZBrush easier to use on devices like the Microsoft Surface, which are not distinctly designed for it. Forger is designed for the iPad – it's a great combination.

Shapr3D also makes use of this fantastic relationship. Its closest equivalent is in fact not Maya, but something more like Moi 3D – however, the developers know its limitations and have totally embraced the gesture and tap-based interface options of Apple's devices, providing a detailed series of free tutorials on their YouTube channel, and in fact within the app itself. Once you have mastered these, it becomes a surprisingly fast and efficient tool, able to produce accurate and complex geo in mere minutes, often beating the time that would take a more conventional tool like Maya to do.

This app in particular has a dedicated feedback forum, and release updates are frequent and well thought through. Recent additions include a better outliner/geo manager, the ability to import DWG files and convert to usable meshes as well as STL files, and a greatly improved drawing mode. It's clear that these guys are really

looking to corner the market in iPad-based CAD.

As for Procreate, I've been using it to add the finishing touches to anything I'm exporting out of Forger or Shapr3D. Effectively it's a substitute for Photoshop, and works as my primary application for concept work. Once again this app has been designed with the iPad Pro specifically in mind, and it has an incredible amount hidden under the hood. So much so, that I would thoroughly recommend attending one of Apple's free lectures at your local Apple Stores on getting up and running in this >



With a quick clean up in ZBrush, this clean geo can be imported into KeyShot for any number of render options. In this case, an ice sculpture



● FEATURE

How light can your mobile studio be?



Final rendered helmet design in KeyShot

ANY HOPE FOR LIGHTING?

LIGHTING IN FORGER IS POSSIBLE

There is some small availability for lighting in these apps: Forger does have a light source you can manipulate, and a very basic range of materials, so it's possible to set a very crude tone before you render your image. However this is currently limited, with only one light source with control over exposure and colour.



Here you can see my dragon model with a basic lighting setup and shiny (Phong) skin surface

> app, because it really is one of the best drawing apps available. Quickly I'm able to add colour layers, import photos, blend textures in and customise my brushes to create a very effective paintover and complete my concept, ready to show to clients.

"YOU CAN CREATE IDEAS ON THE GO, AND THEN DOWNLOAD THESE CONCEPTS TO A MORE POWERFUL MACHINE"

In order to fully release the potential of this setup, I've embraced Apple's recommendation to use as many of its products as possible, signing up for iCloud storage and linking my other Apple devices (an iPhone X and an older iPad Mini). This is actually the key to this whole enterprise: the iPad alone will not suffice, you need the cloud-based storage to make this workable, not just for its size, but also for its ease of access and shareability. In addition, syncing my iPhone makes my digital content available to me 24/7 wherever I may be, whether I have my iPad or not, meaning I can remotely download, share, move and store all my files whenever. It also becomes increasingly simple to add supporting content like

photo refs and video using the iPhone's camera and syncing my files automatically – when I turn either device on, bam! There is my content, shared and ready to go.

One of my favourite uses of this bridge is the app Heges, which utilises the iPhone X's front-facing camera to create instant 3D scans of your face (you can also run it on an iPad Pro). As a workflow example, I can scan anyone I meet on the iPhone, upload it to the cloud (these files are large) and download it onto a 3D viewer on my iPad such as emb3d.com, where I can convert into an OBJ and load into Forger.

CONCLUSIONS

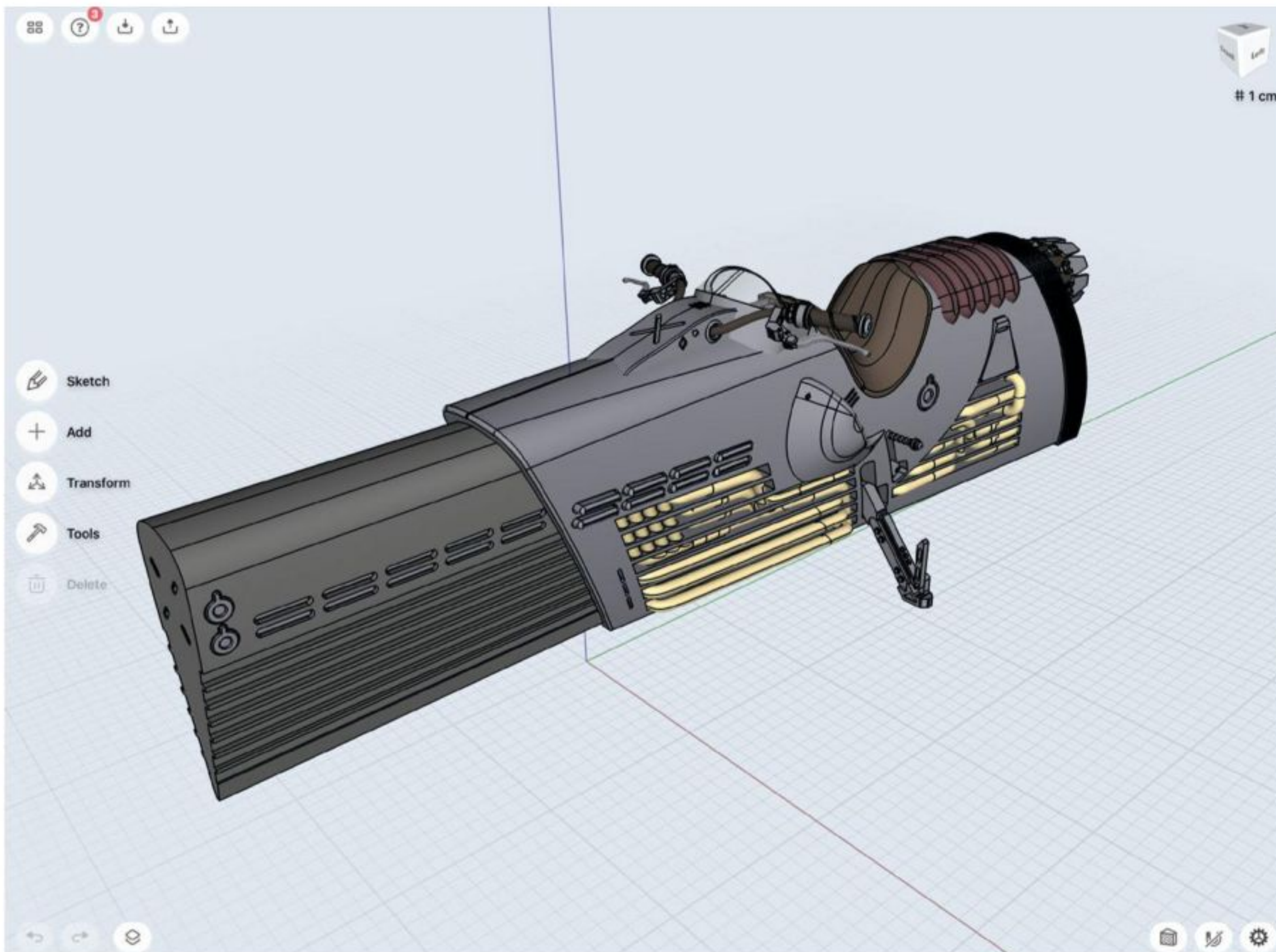
The conclusion here for me is simple: this setup cannot do what a Wacom MobileStudio can. Without the processing power to fully animate and render, it will remain quite limited. However, with more and more of these types of apps coming out, I don't think that day is very far off. At less than half the price of a Wacom MobileStudio, it's just much more accessible, and it's fun to use! I would honestly

recommend downloading all these apps now, or splashing out on an iPad Pro if you don't already have one, as it's a great substitute if you want to conceive ideas, or just practise your modelling/sculpting skills. When you have the ability to create ideas and model/sculpt on the go, and then download those concepts to a more powerful machine to render out stills in software such as KeyShot, it becomes a hugely powerful tool – you can always be producing artwork without the restrictions and confines of a studio or office. Since adopting this workflow, I've found myself creating more and the simple truth is, it's just much more accessible to your everyday life. Given another year, who knows what will be possible?

BRING RENDERS BACK INTO PROCREATE

HOW TO UTILISE PROCREATE FOR FURTHER CONCEPT TWEAKS

For the hoverbike I modelled in Shapr3D, and rendered in KeyShot, I wanted to add some old-school 'pin-up' artwork to the side. My colleague, Lola Hale, designed a great demon girl to go on the side of one of the green renders. This was conceived and painted in Procreate, and then composited onto the render using layers in Procreate.



Top: A hoverbike model in Shapr3D. The app enables you to create complex designs with ease using its selection of powerful tools

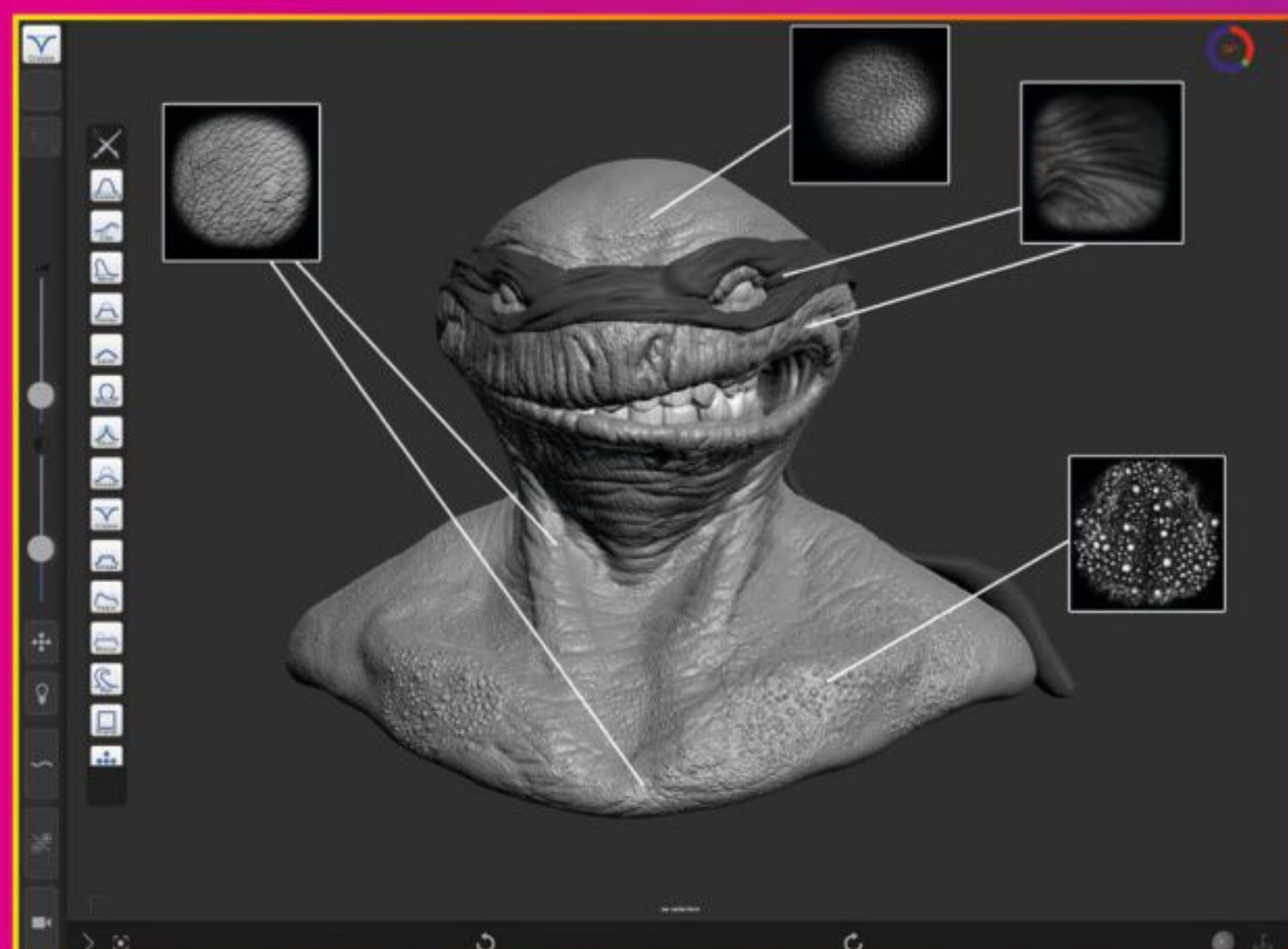
Right: This hoverbike was created using a combination of Shapr3D, KeyShot and Procreate

Above: A dragon sculpt created in Forger



● FEATURE

How light can your mobile studio be?



01



02



03



04

05



06

HOW TO DO A BASIC PAINTOVER IN PROCREATE

01. SCULPT IN FORGER

Sculpting in Forger is very similar to ZBrush, you can push and pull your forms and remesh at any point. It contains an object outliner and layers, so after a little practice, the interface becomes pretty familiar. Here I've imported some of my own stamps to create a layer of detail for the stamp brush, which only operates in drag rectangular mode. To make this work I have to ensure all my stamps have a decent feathering. Achieving this type of detailing is, I believe, a first for any app-based sculpting program – my final model is around 3.5 million polys.

02. RENDER IN FORGER

Rendering in Forger is limited, but you can do some basic material assignments and change the location of the single light source. So I'm rendering out some passes to comp together in Procreate. A single left light, top, bottom and right. I'm also approximating something like an ambient occlusion pass, and assigning a very specular Blinn to the skin surface.

03. LAYER IN PROCREATE

Once I have my renders, I can start the paint-over process. First I bring all my images into Procreate and stack them in the layers box. I can now start to make new layers, like a colour pass that has a clipping mask to the basic render below it. This way I can paint the basic colours on top of my render. I also speckle in some variation with a spotty brush of light and dark spots to vary the skin tone. Most of my layers are set to Screen, Soft Light or Lighter Color.

04. LET THERE BE LIGHT!

I'm going to try out all my lighting passes, and possibly

blend them to give a faked global illumination. During this process I realise that I like the left side light the best, and focus on a concept that utilises this light source most. The other passes are still blended in to a degree, and to do this I set each layer to Screen and turn down the opacity until I am happy with the result. I'm also assigning a colour to my left light as a clipping mask. I rendered the lights all in white, so I simply have to create a fill layer above it and then set that to colour and clipping mask, and it should give me a nice yellow light source to work with.

05. TEXTURE DETAIL

I've downloaded some nice photo reference of lizard skin and some green eyeballs. I'm importing these images into Procreate on separate layers and then using masks to reveal the sections of texture I want. For something that's just a concept paintover, I'm not fussy about getting it exactly right. I really just want to capture the feel, so this is a nice quick way to add some real-world details to the final image. I'm also using a crosshatched brush to give the fabric of the bandana a little textured feel.

06. BACKGROUND

Setting any image against black will seem a little boring. With my strong left side light source, it would be nice to play that up a bit more, so using a few of Procreate's default brushes I can add some cool effects to the background to make it pop a bit more. I use three brushes for this, nebula, grunge and halftone, and layer each one on top of the next to give it a sort of comic-y look, but with the mysterious light from the turtle mutagen. TURTLE POWER!



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3D BUST

Find out how to take a
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AUTODESK MAYA

RECREATE A STYLISED PORTRAIT IN 3D

Use some of Maya's more advanced tools
to recreate a stylised concept in 3D



AUTHOR

Antony Ward

Antony Ward, aka antCGi, has been creating digital content for decades. Be it game development, rigging or recording in-depth courses for his YouTube channel, he boasts experience in most areas of 3D.
www.antcgi.com

For a few years now I've been exploring another aspect to my art skills, and have instead focused more on digital painting in my spare time than sculpting or modelling. I felt that my 2D skills were waning so wanted to bring them back up to a reasonable level where I wasn't terrified if a client asked for a concept. As you can see, my portraits are a little strange. I much prefer the more stylised approach when it comes to artwork, I find it more interesting to create and to look at.

Up to now these two sides of my career have remained separate, so I thought it would be fun to take one of my concepts and recreate her in glorious 3D. What's more, I thought I'd share the process with you lucky readers, so you can do the same.

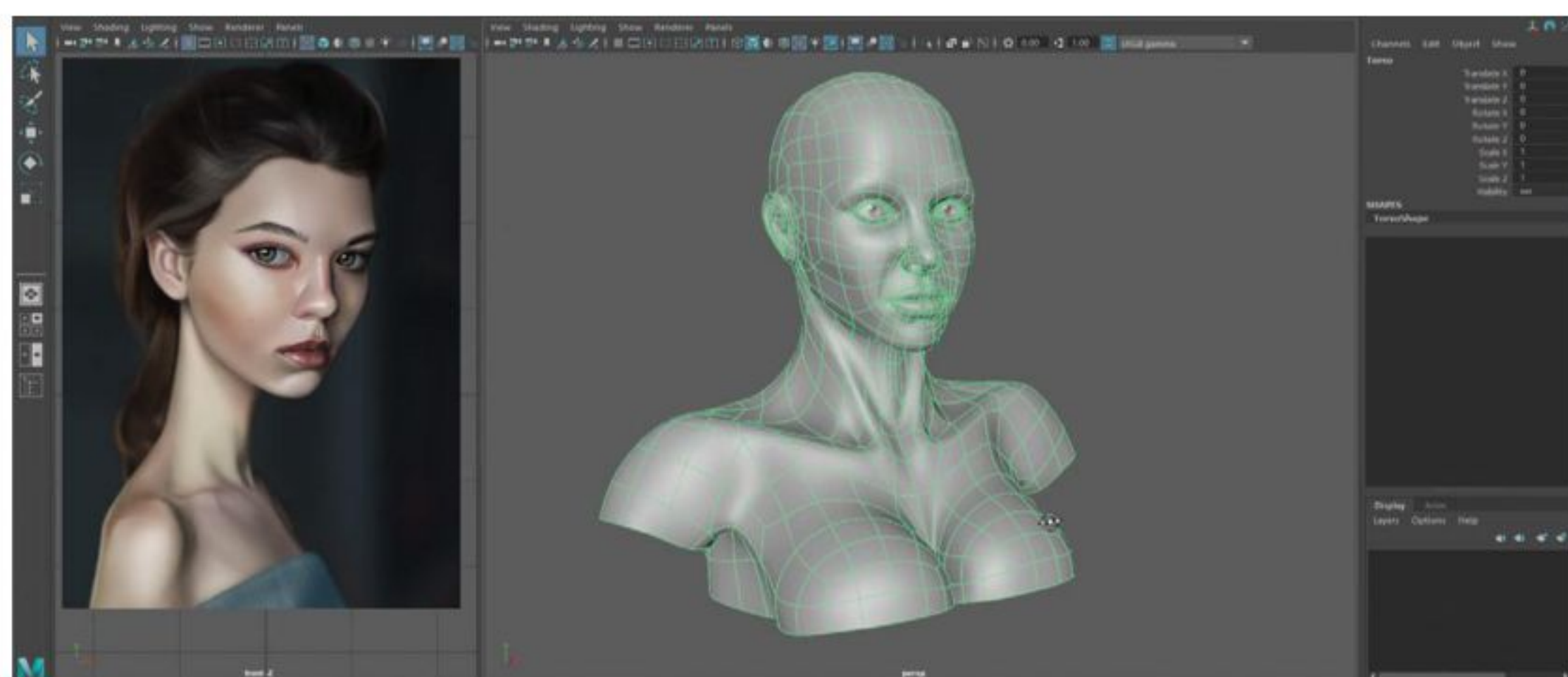
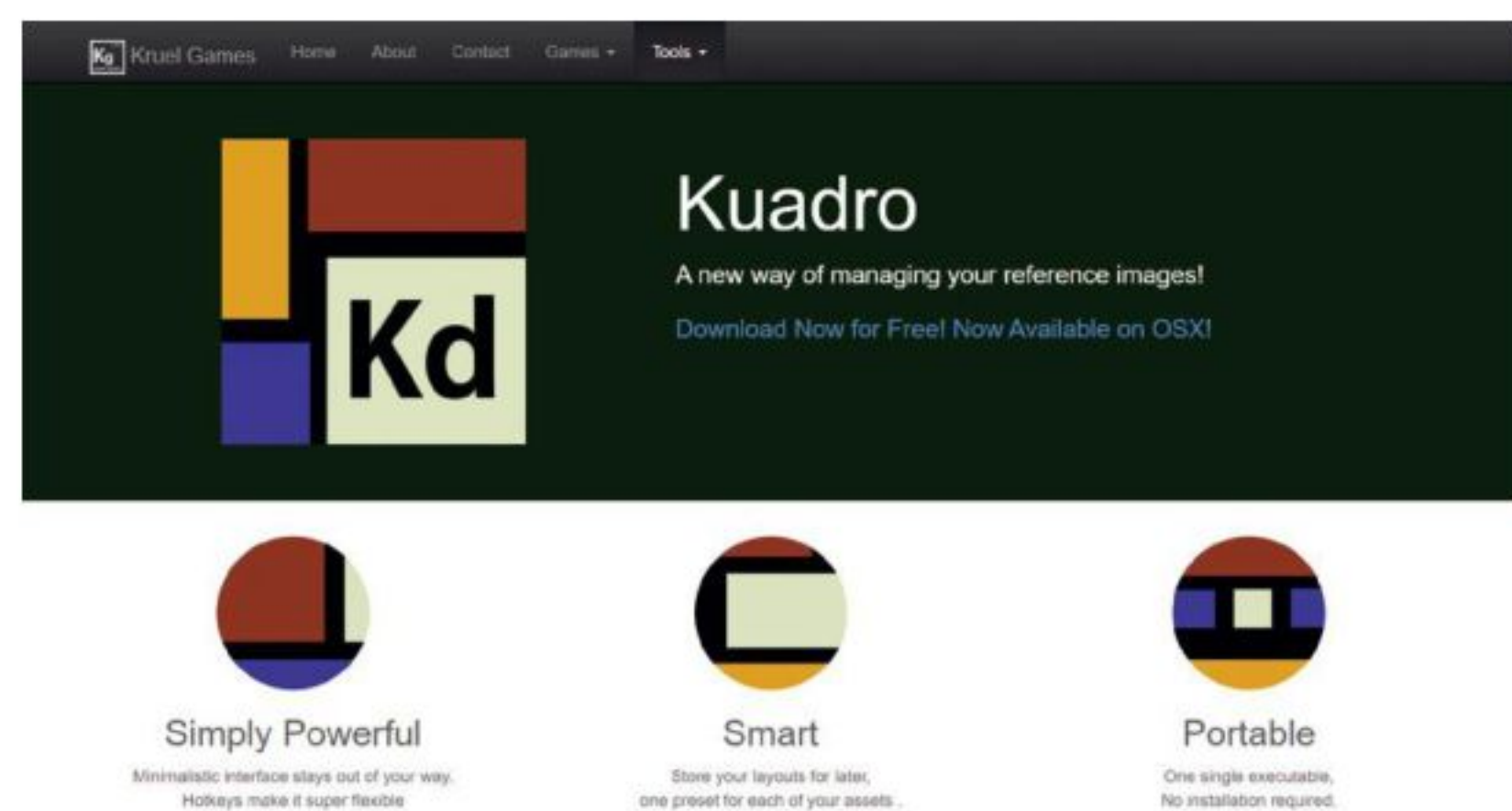
Now, we aren't going to create an exact, one-for-one replication of the concept. As with anything that's created in two dimensions, sometimes an exact 3D copy doesn't look right. Instead we will take inspiration from its style and proportions to recreate the portrait using some of today's top techniques, like the Arnold skin shader and Maya's XGen tools to replicate the hair.

As you can imagine, this is a lengthy process, so I've tried to cover the key areas here, but for a more detailed tutorial please follow the accompanying videos. >



DOWNLOAD YOUR RESOURCES

For all the assets you need go to
www.bit.ly/3DW-254



01 GATHER YOUR REFERENCE

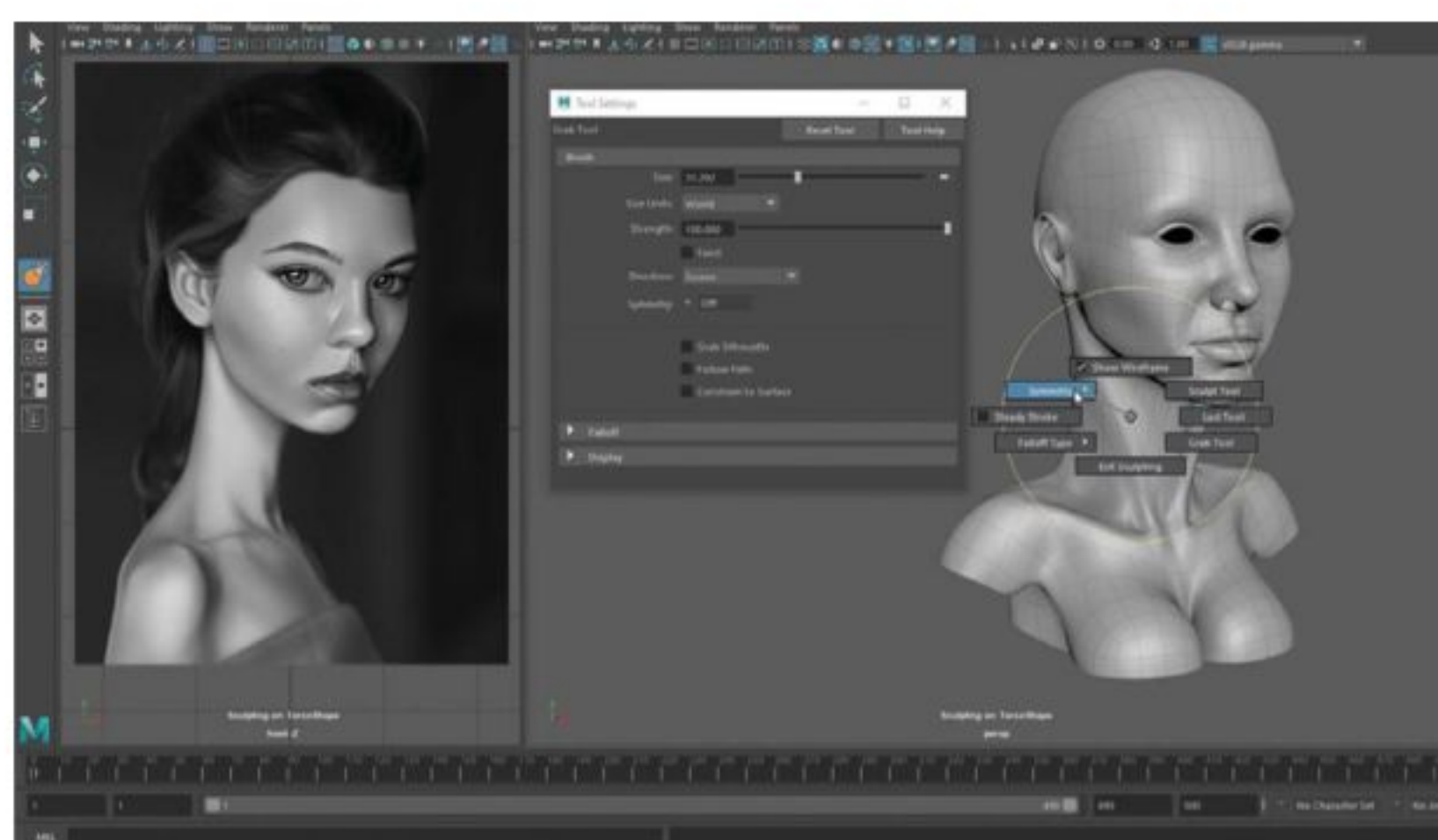
Before embarking on any project it's essential to have a folder of reference at your disposal, but having these images readily available while you work can be troublesome. A great free application I use is Kuadro, (kruegames.com/tools/kuadro). Not only can you position your reference material around your screen, but you can also store the layout for future use.

02 RECYCLE OLD MODELS

Every digital artist should have a back catalogue of models and textures in their library. There's no point building everything from scratch when you have a model that can give you a head start. For this project you can reuse a model that I created for another *3D World* tutorial back in 2016, where I created a steampunk bust. Looking back, the proportions aren't right, and the topology needs work, I'll admit that, but beginning here will likely save you a day or so's work.

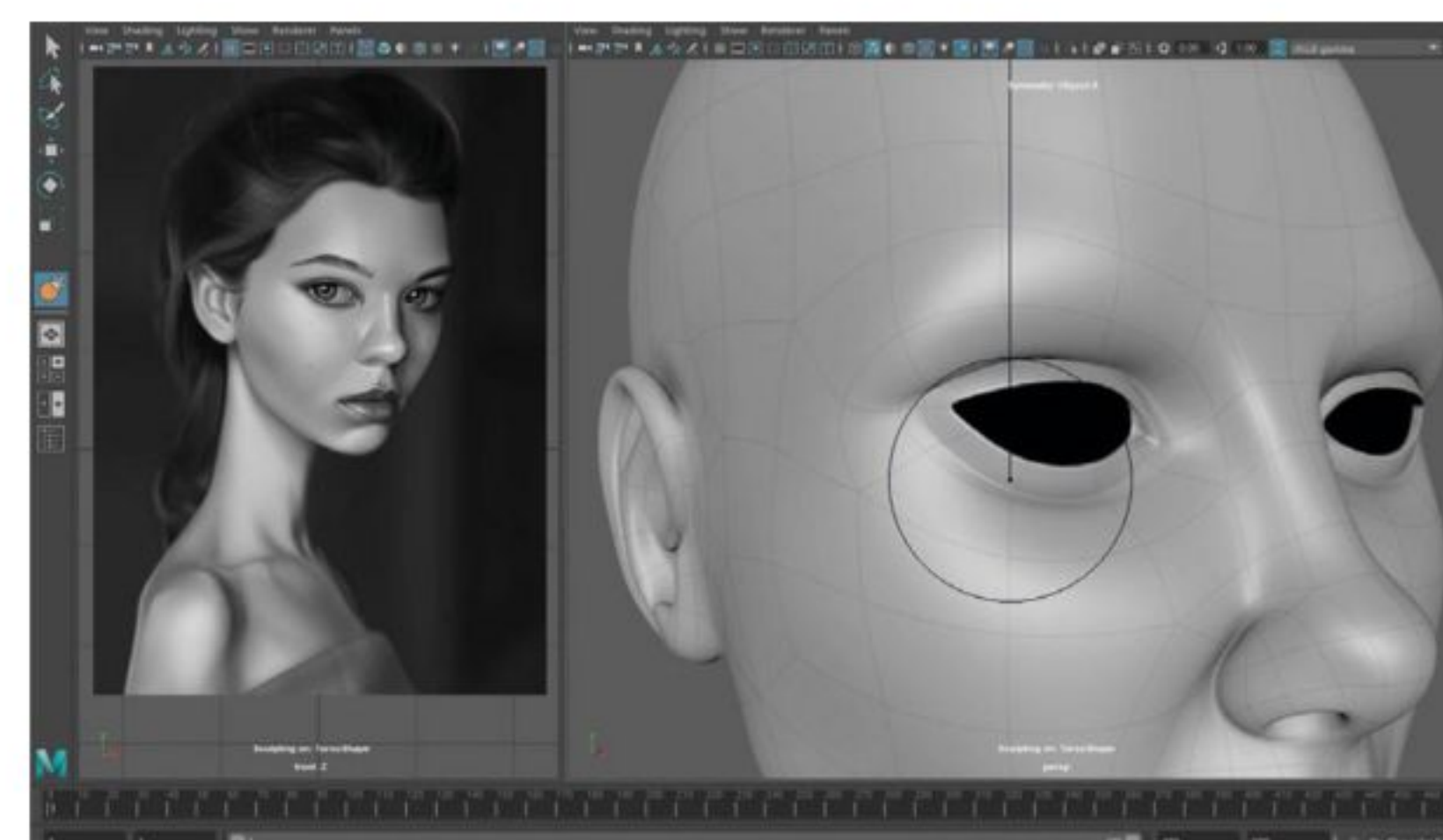
Convert to greyscale

When creating the main model, I prefer to use a greyscale reference image so I can focus on shapes and forms, rather than tones. Luckily, Kuadro allows you to do this easily by simply right-clicking on the image and selecting Toggle Greyscale.



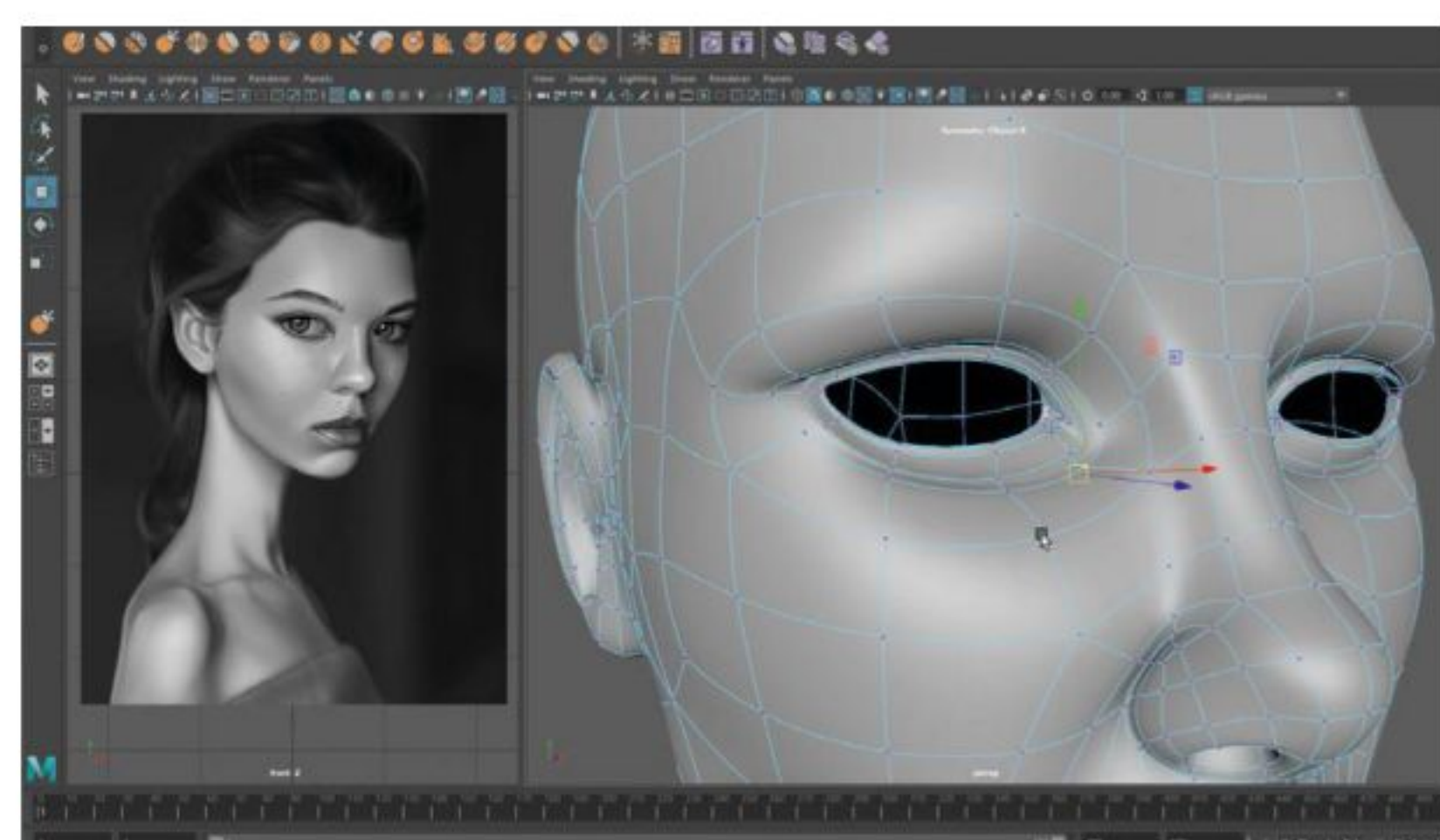
03 SCALE DOWN HER TORSO

As this is a stylised portrait you have plenty of work to do to match the proportions in the concept image. For this initial step, use Maya's sculpting tools to shrink down the torso and lengthen the neck. I find the Grab tool to be the most efficient way to do this. If you also enable symmetry in the options, you can work on both sides at the same time.



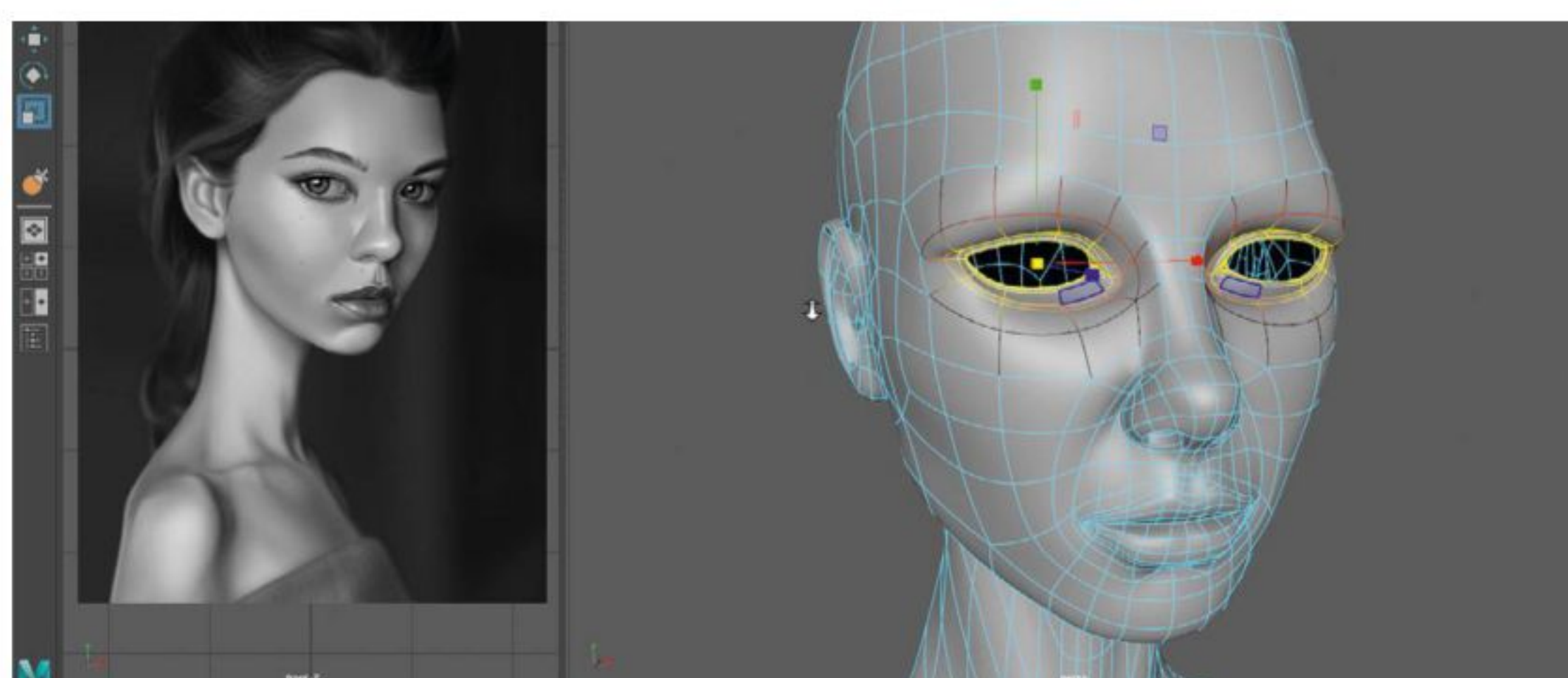
04 ADJUST FACIAL FEATURES

Next, move up to the face and start to adjust her features. Again, just use the Grab tool to pull the geometry around to make her eyes larger and reshape her nose to fit that of the concept. To help, keep moving the camera to pose the model to match the concept so you can get a clearer view of how she should look. For now you are just looking for a rough approximation.



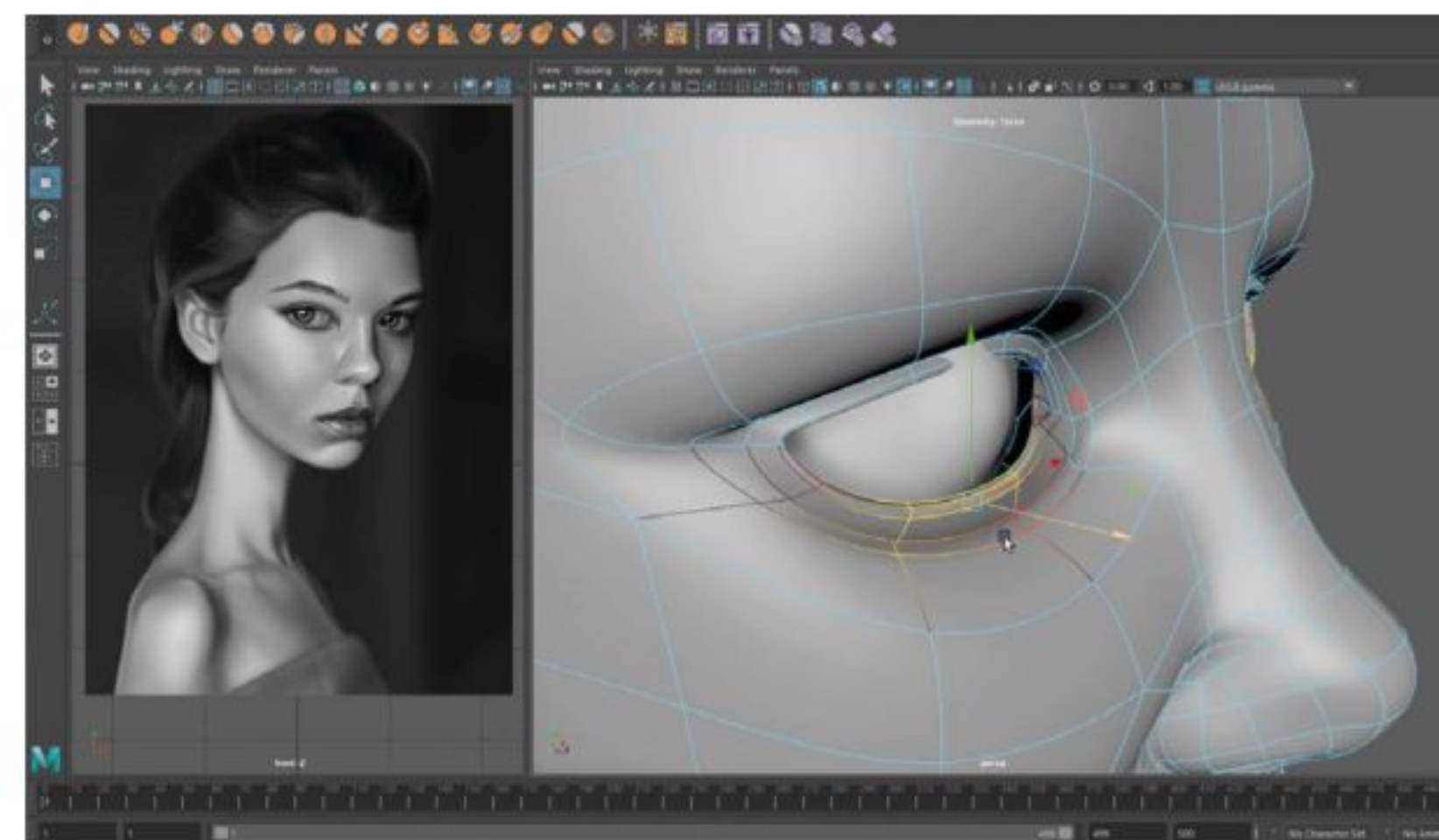
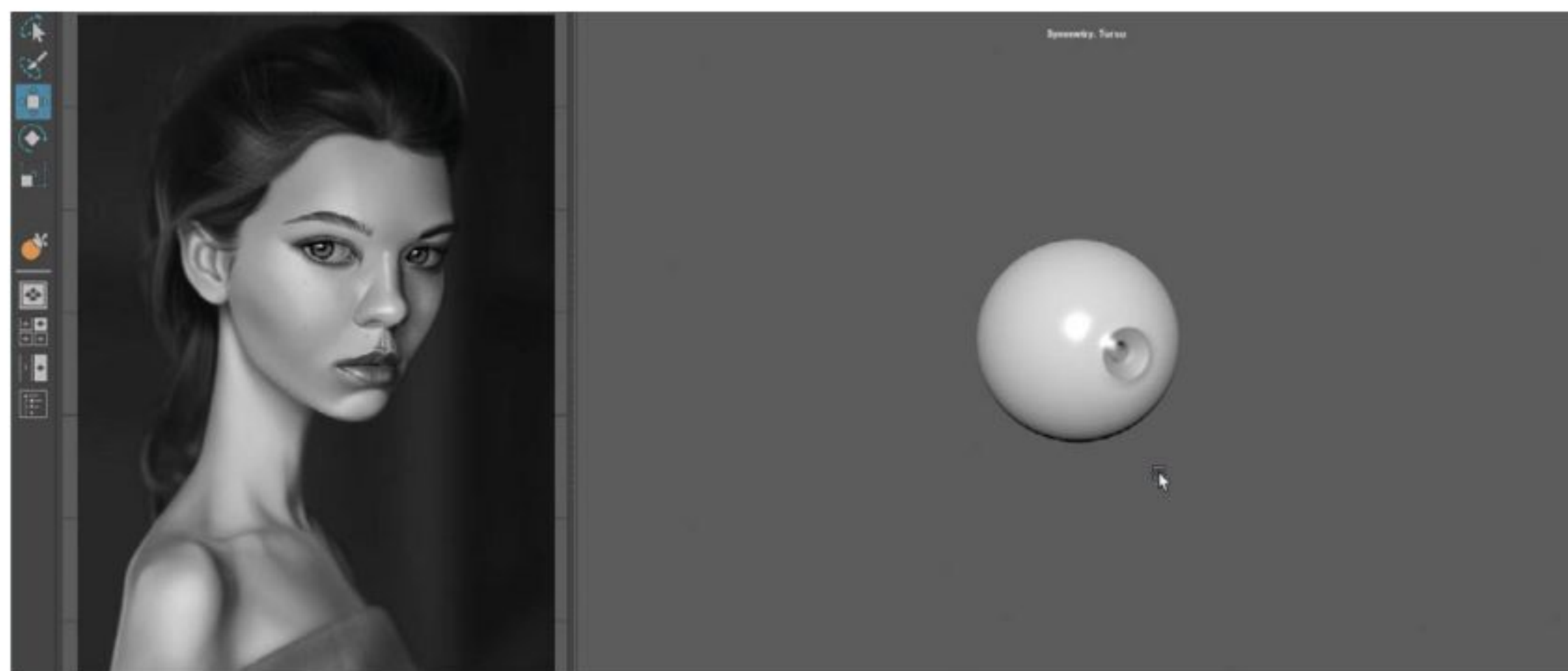
05 REFINE THE SHAPES

Now that you have some basic proportions in place you can start to go in and adjust the areas on a vertex level. You can work on the proxy model, which has fewer components yet is smoothed to give the illusion it has a much higher density. This will allow you to enhance the creases around the eye and nostrils as well as adjust the cheeks to enhance her cheek bones.



06 USE SOFT SELECTION

There will be times when you need the area you're working on to also affect the surrounding geometry, like enlarging the eyes for instance. To do this you can simply select the inner eyelid geometry and press B to enable Soft Selection. This gives the selection a falloff, so as you scale the eye area, the surrounding polygons scale too, but its effect gradually fades. This is a similar workflow to using Maya's sculpting toolset, but for this kind of work I find Soft Selection to be more precise, meaning you get the exact changes you need.



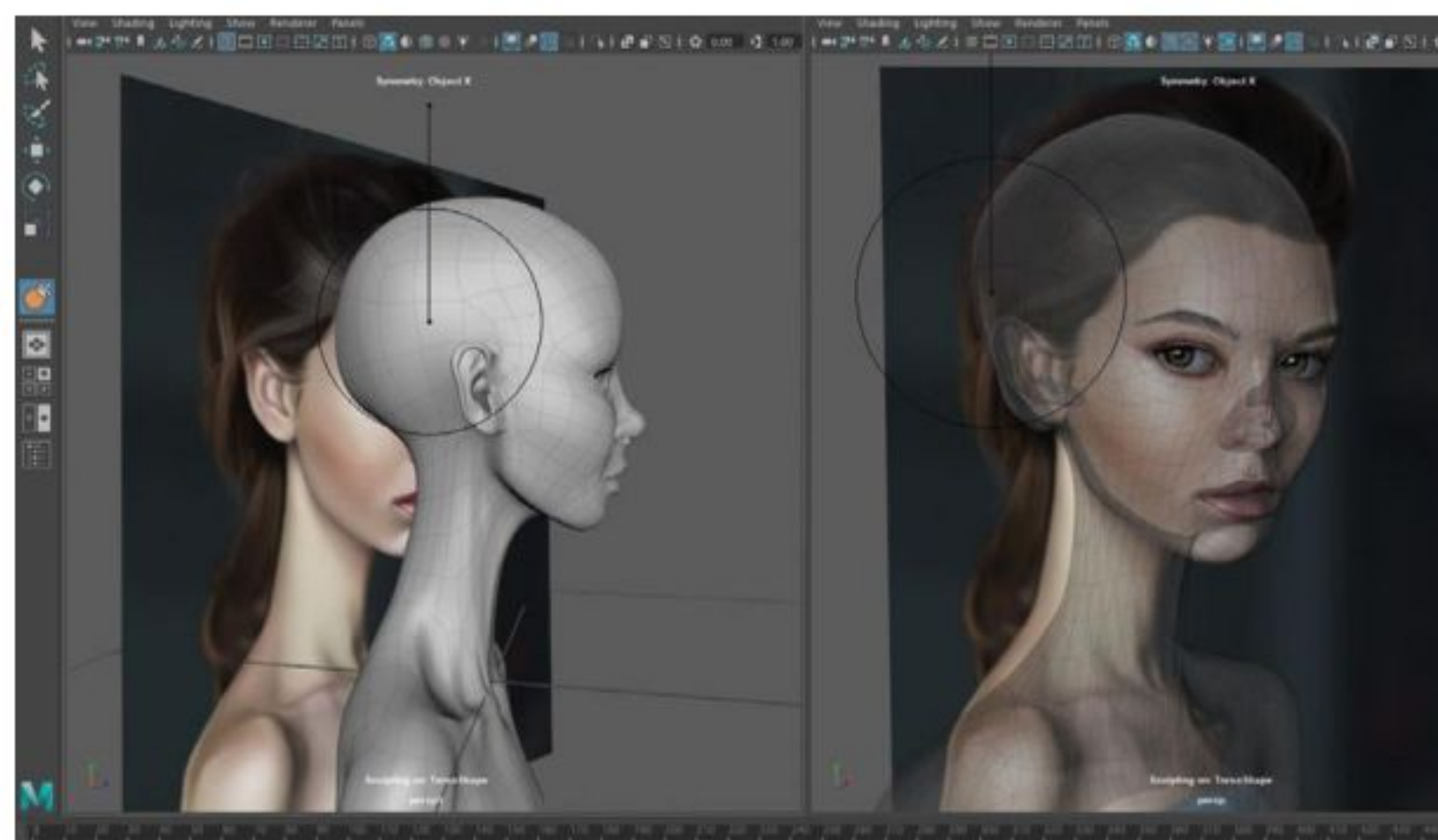
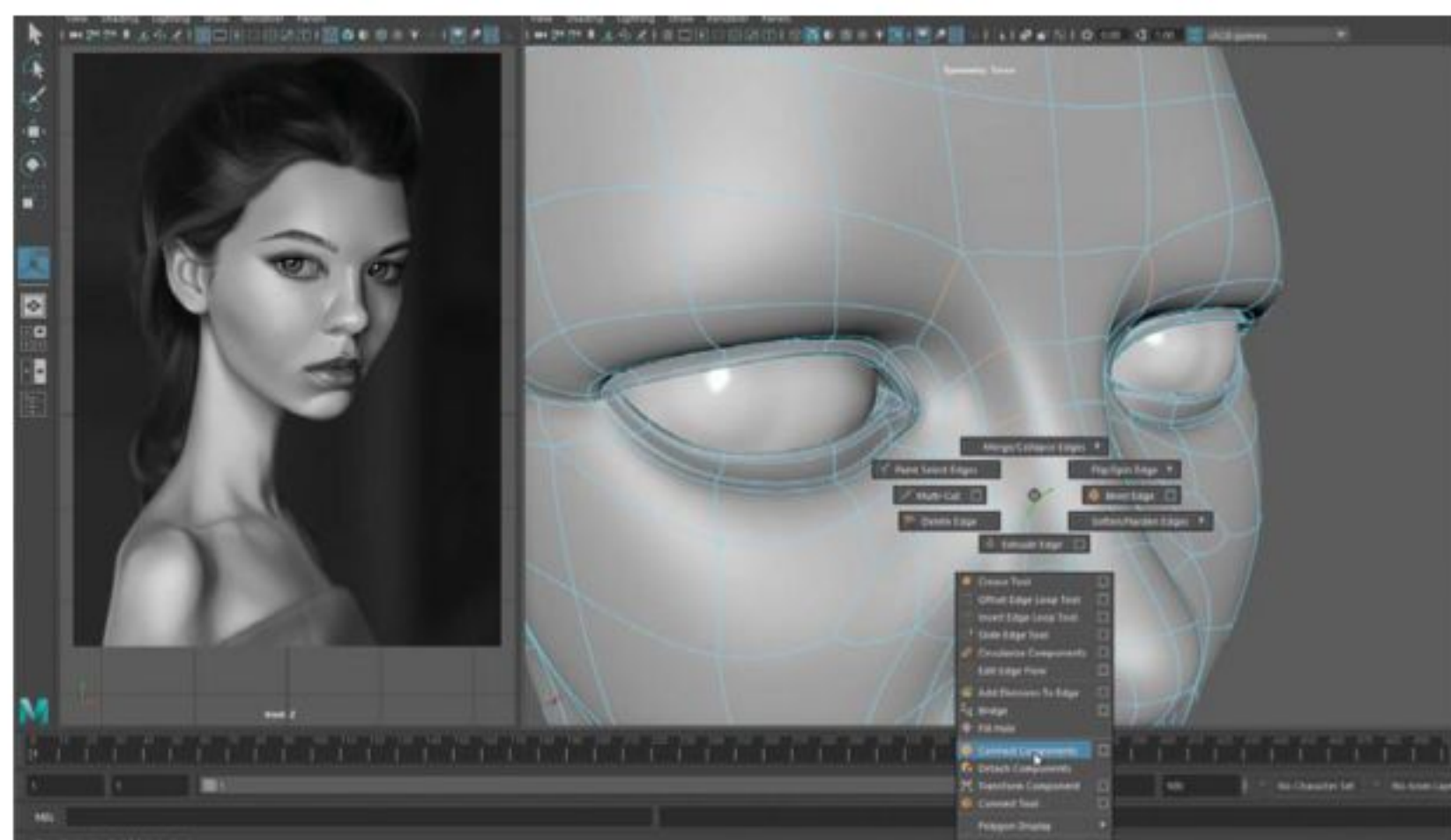
07 UPDATE THE EYE MODELS

It's at this stage that you need to get the eye models into the scene, and as with the main model I have some already built. The problem is, looking at them now, the proportions are all over the place. It's amazing what you learn when looking back on older models, and where you messed up.

You can either use the supplied models and adjust the proportions accordingly, or create your own basic eye models and position them inside the head.

08 ADJUST THE EYELIDS TO FIT

Now you have the eye models in place you can rework the eyelids to fit around them, giving you a much nicer eye shape. Remember to also include the caruncle, which is the small ball that sits in the corner of the eye. This can be built into the main shape as it is here, but I usually prefer to include this as a separate model later when it comes to rendering.



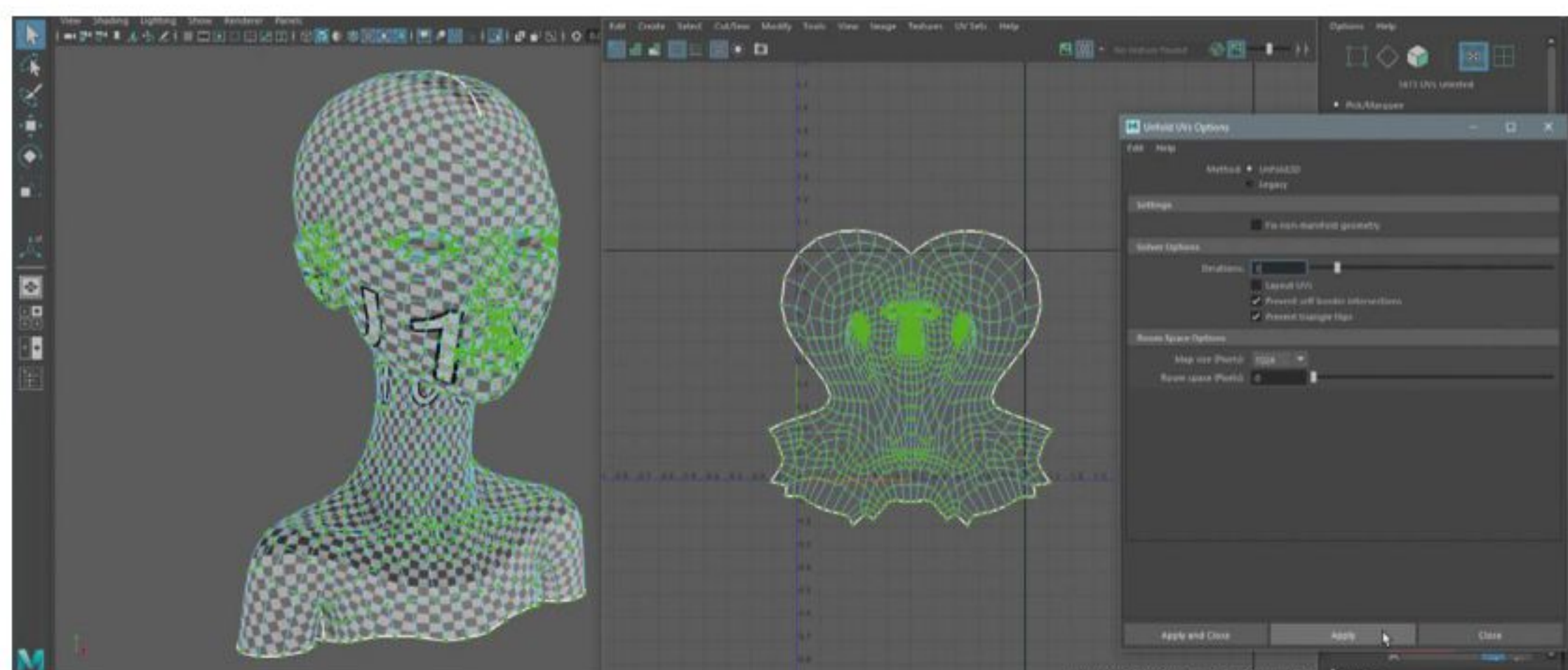
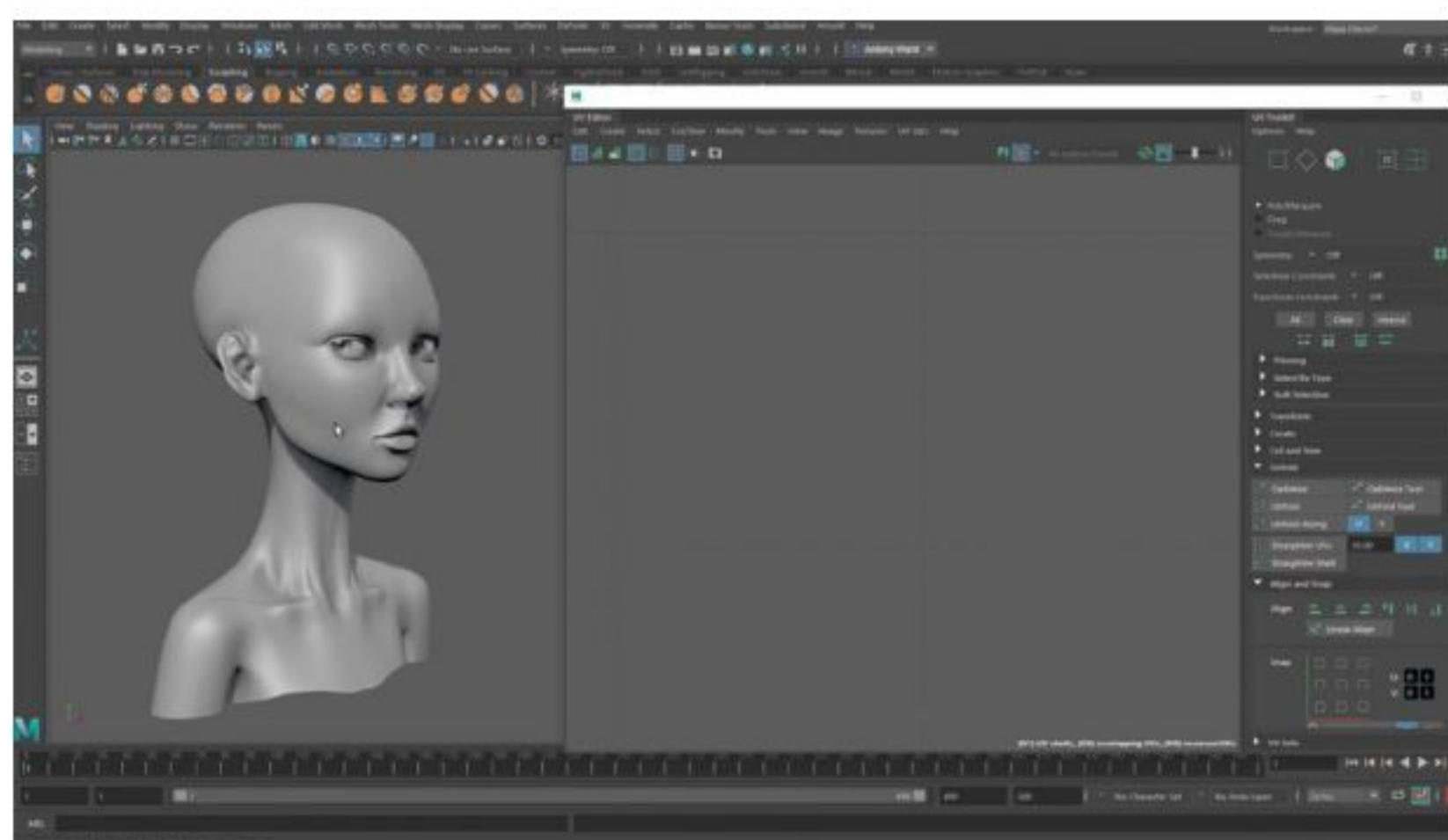
Fill the holes
Before you unfold your UVs, fill the holes in the model like the eye sockets, nostrils and the mouth. This will result in a much better UV layout and you can delete the polygons after.

09 REWORK THE NOSE TOPOLOGY

There are plenty of areas on this model where the topology can be reworked, not only to improve the edge flow but also enhance the model. My preferred approach is to use the Connect Components tool to quickly add an edge loop, like on the sides of the nose to sharpen the edges. It takes a bit more work, but you get more control over your topology.

10 IMAGE PLANE REFERENCE

Continue to work on the overall shape and the topology, and once you get to a stage where you are happy, import the concept art into the Maya viewport as an image plane. Doing this will allow you to then place the model over the top of the concept so you get a better fit. You can then use Maya's sculpting tools again, particularly the Grab tool, to adjust the proportions.



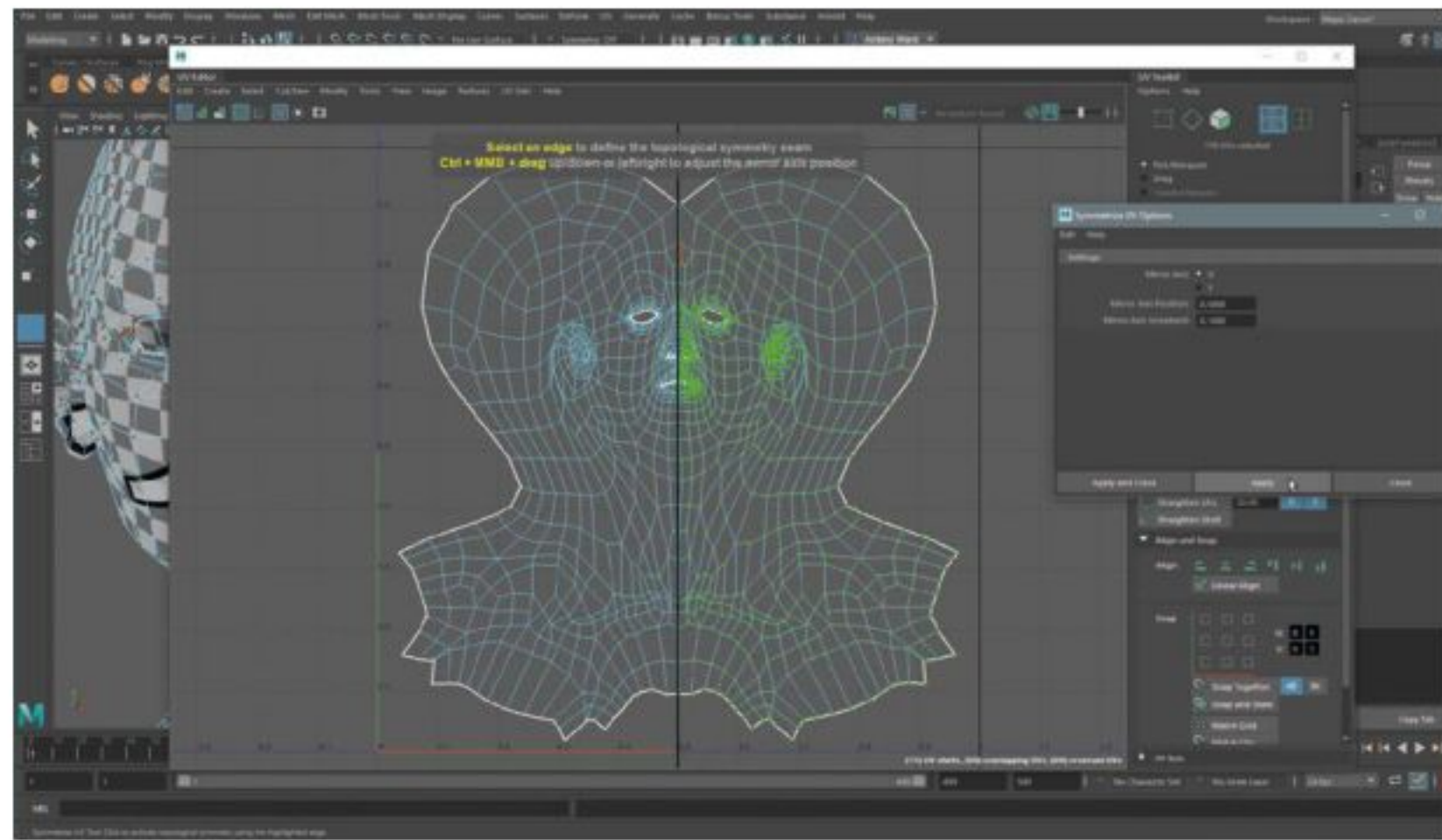
11 TIME FOR UVs

The model is probably 90 per cent complete with regards to proportions, but the way it looks will change once you start to add skin shaders, hair and eyelashes. For now, it makes sense to work on the UV map and then you can generate the textures, meaning you can make the final model tweaks later. Open the UV Editor and select the model. Don't worry if the current UVs are a mess.

12 PROJECT AND UNFOLD

For a simple bust like this an initial Planar Projection down the Z axis will give you the best starting point. All you need to do then is select the edges that run from the top of the head and down the spine, and then cut them to create a seam. With this model we also have the upper arms, so make sure to cut the edges on the inside of those to open them up.

Once this stage is complete you can simply use the Unfold3D tool to unwrap the UVs.



13 MAKE THE UVs SYMMETRICAL

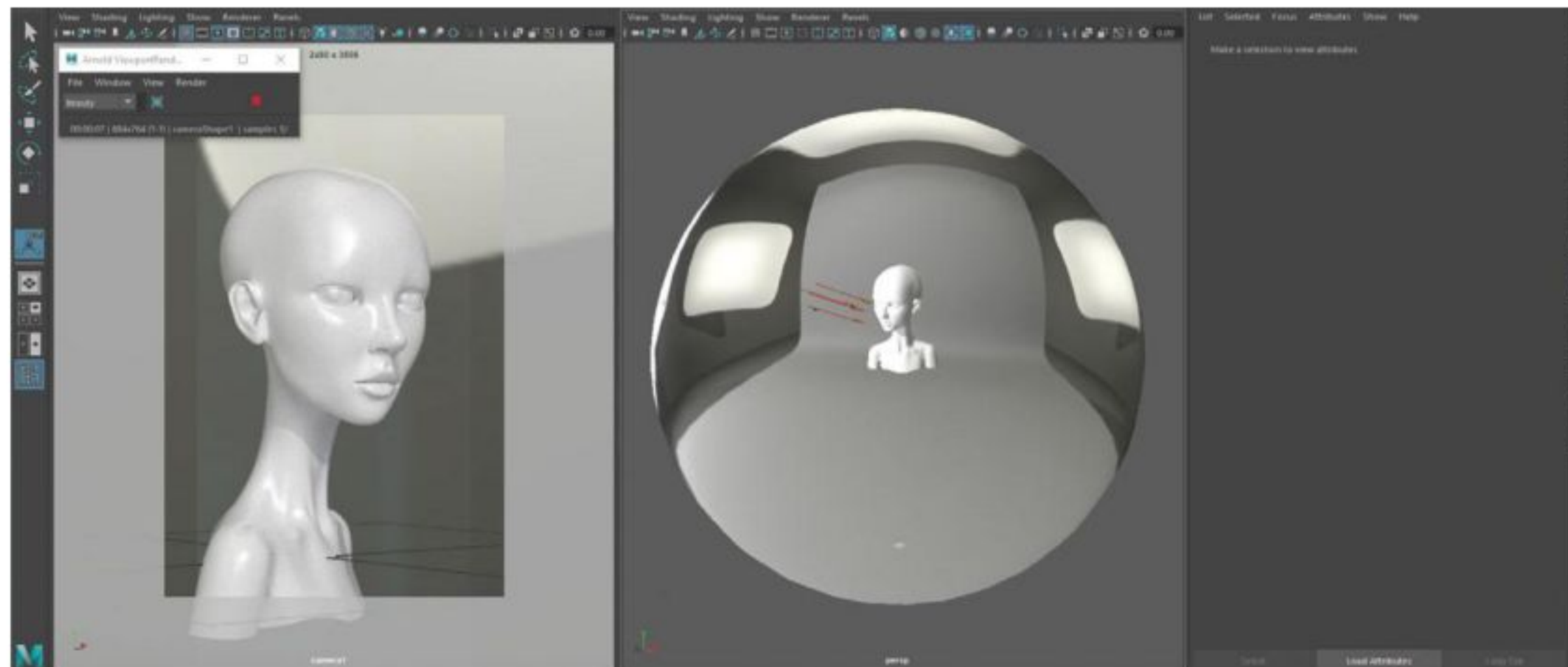
Unfold3D gives you a great set of UVs, but the problem is they aren't symmetrical. To correct this all you need to do is open the Symmetrize UV tool and select the UVs on the side you want to keep. When you click Apply you will be prompted to define the seam of symmetry, and once one is selected the UVs will now match the selected side perfectly.



14 CREATE YOUR TEXTURES

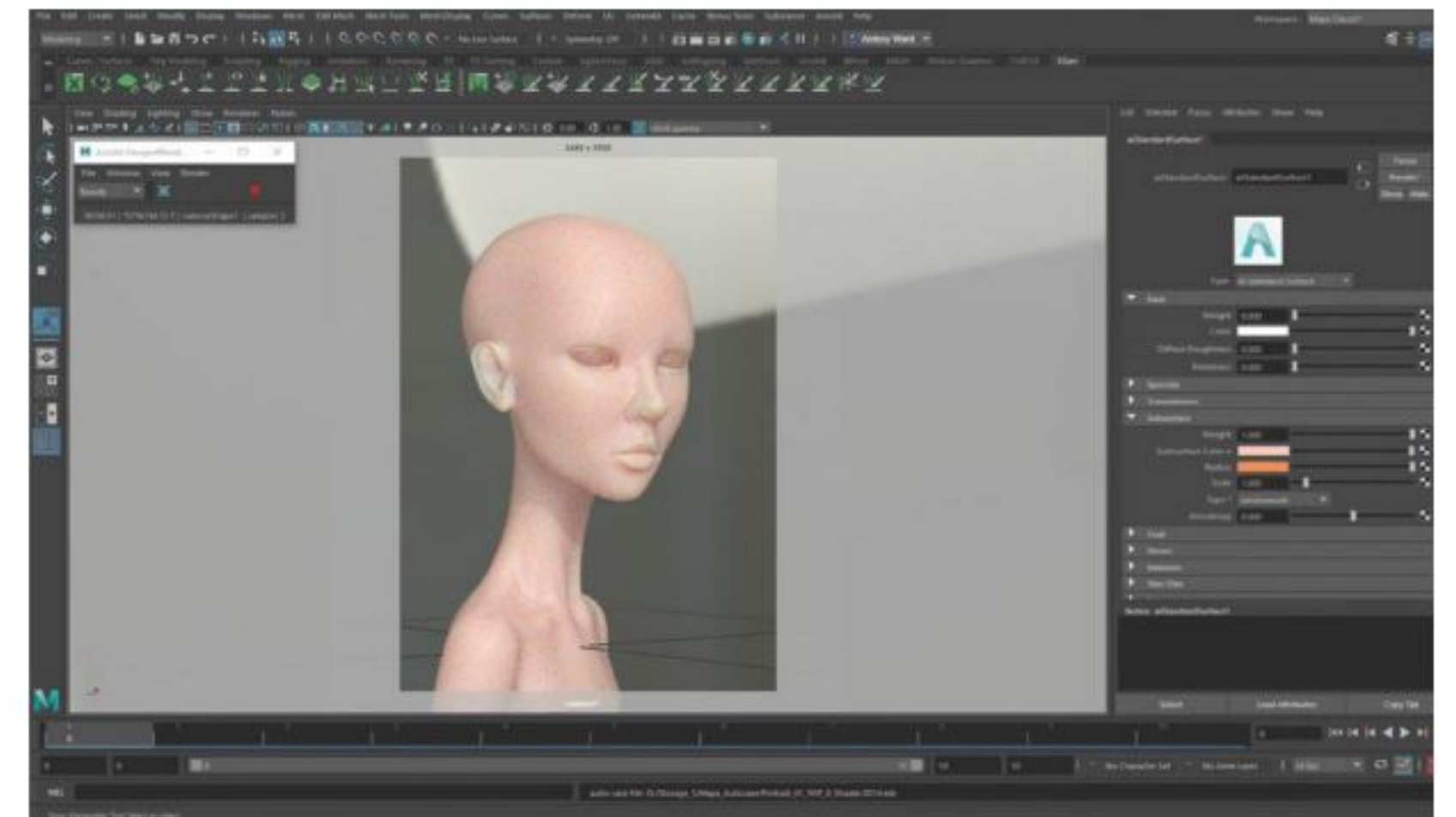
There are many ways to create base textures these days, and for the skin diffuse map I simply used Photoshop and the good old Liquify tool to match an older, unwrapped head texture with this model's UVs. You can export the UVs as a UV snapshot in the UV Editor, which you can then import as a layer to help guide you.

I then took this and the model into Substance Painter and worked on her further to generate the normal, bump, specular and roughness maps.



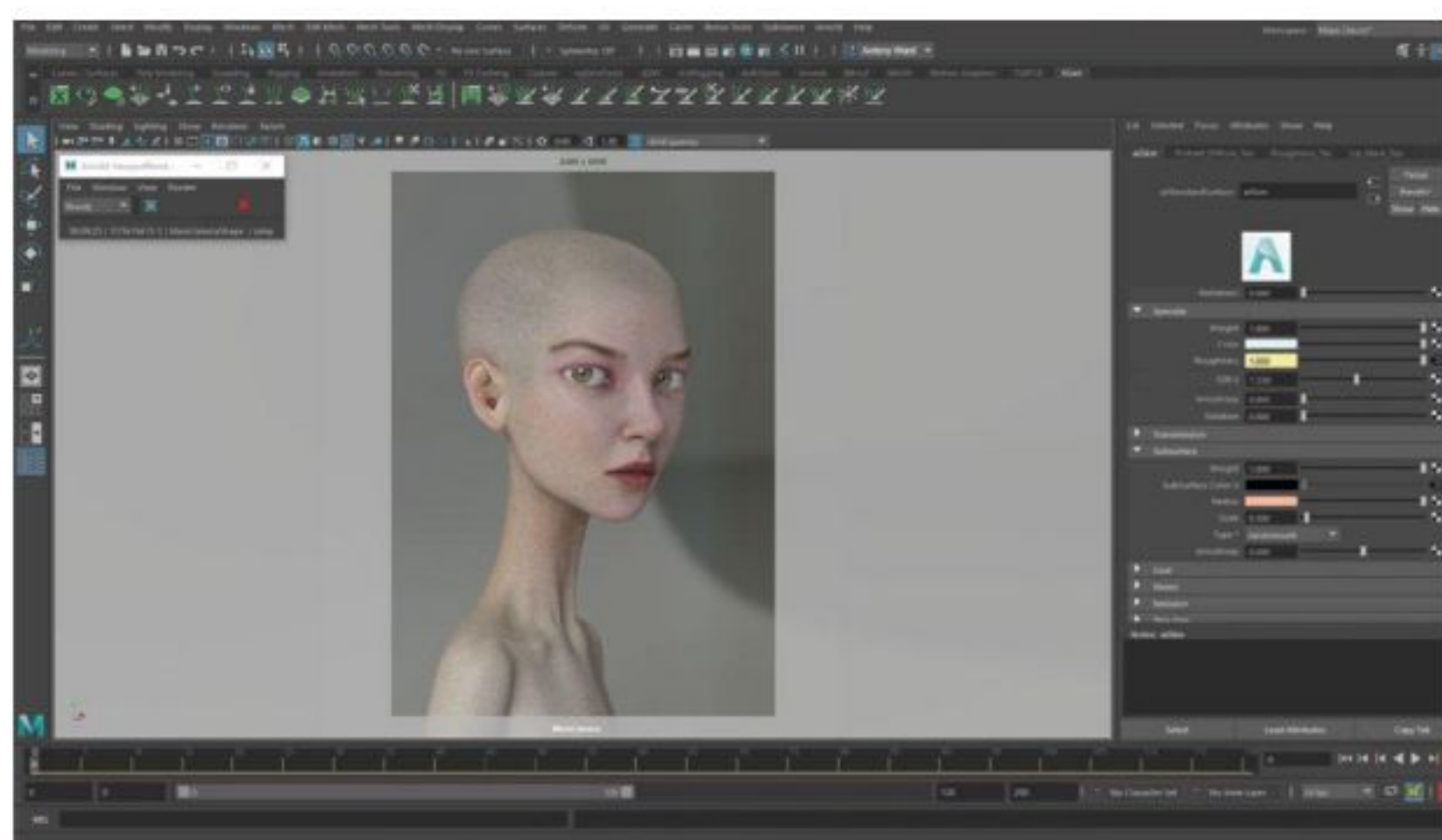
15 SCENE LIGHTING

With the base textures ready it's time to think about the shaders, but before that it's a good idea to get some lighting in the scene. To get some general environmental lighting use an Arnold SkyDomeLight, and pipe a good HDR texture into the color channel. Next create another light, this could be a directional light or a spotlight. This will give you more highlights, plus the main shadows needed to ground the scene. For best results make sure that you enable the Arnold viewport, this way you see updates in real time.



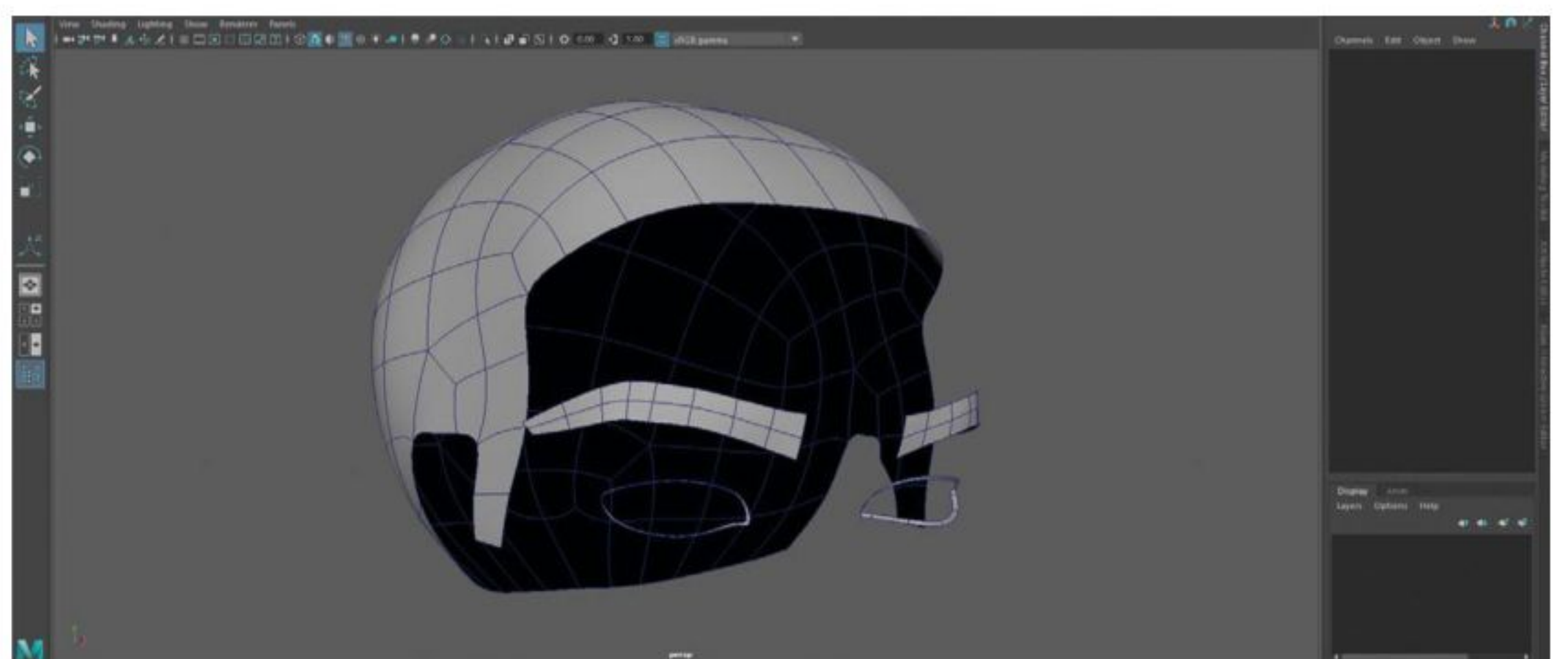
16 SKIN SHADING

Create a new aiStandardSurface shader and apply it to the model. This is a great all-round shader as it covers almost all textures and surfaces, even skin. If you go to the Attribute Editor and click on the Presets* tab at the top you will be given a list of predefined elements ranging from Milk to Gold. Select Skin and then Replace, which will update the whole shader with these settings.



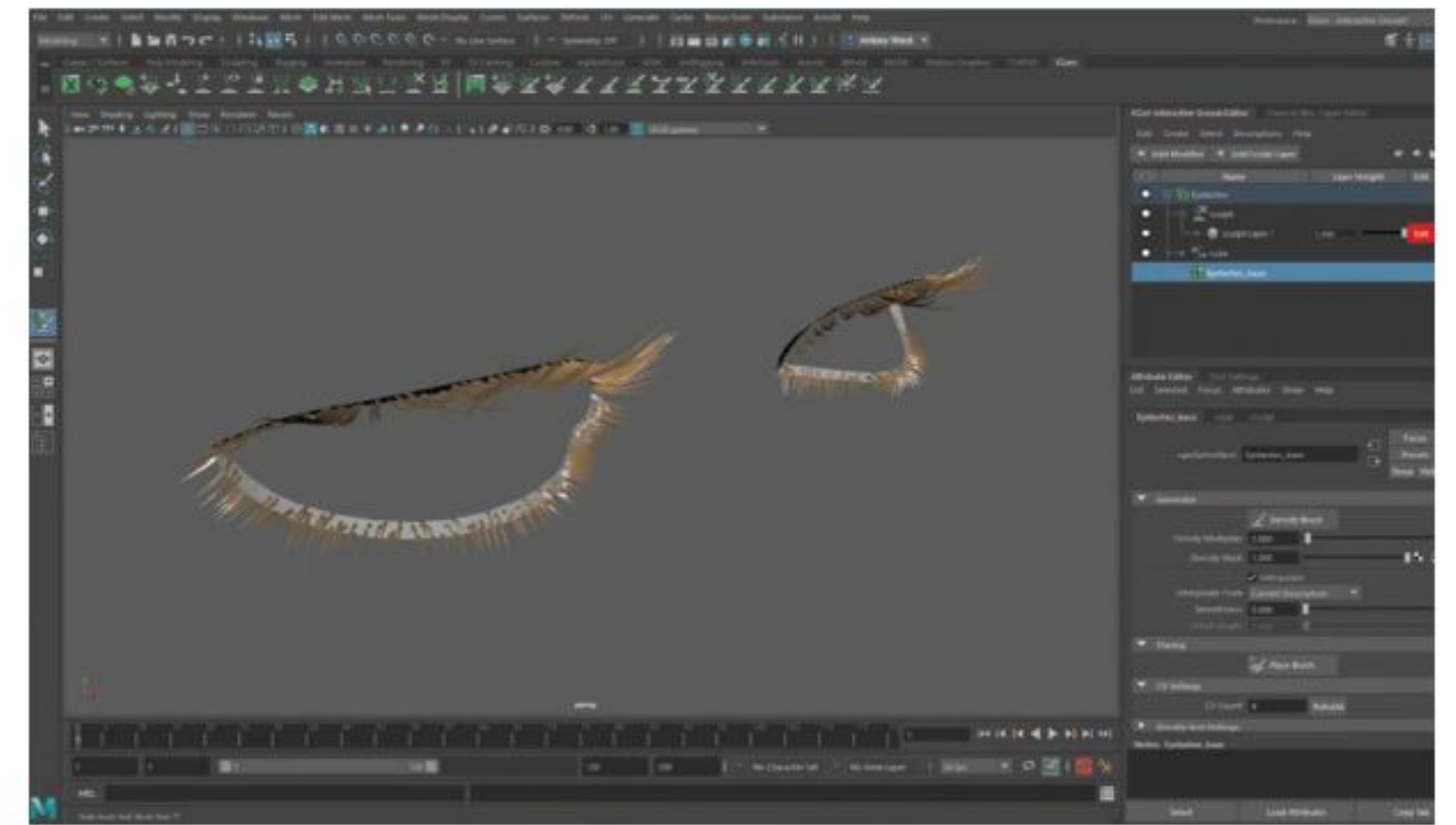
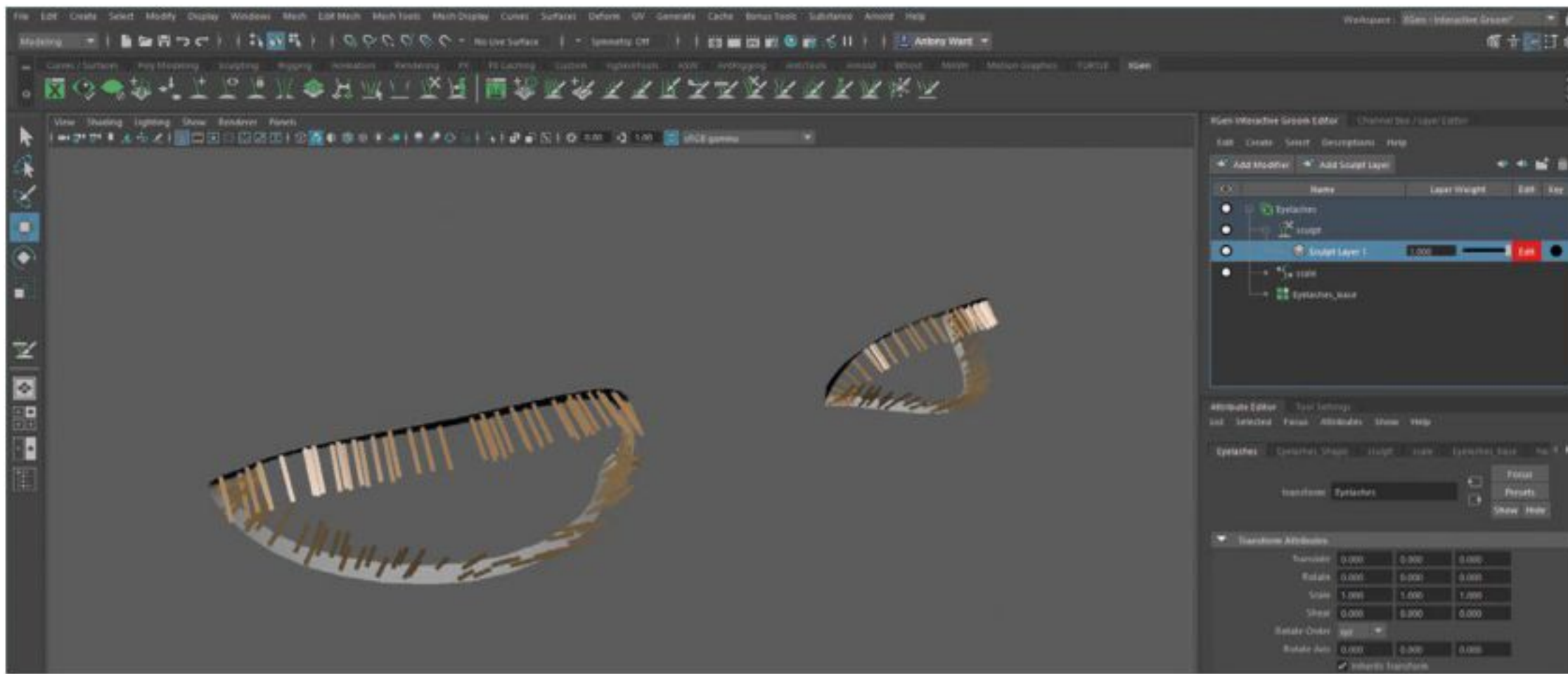
17 APPLY YOUR TEXTURES

Connect the diffuse texture to the Subsurface Color attribute under the Subsurface tab. You may also need to adjust the Scale attribute to get the right amount of scattering. Try 0.3 for now. Open the Specular tab next and connect the Roughness map to the Roughness attribute. Finally move down to the Geometry tab and connect your normal map to the Bump Mapping channel.



18 XGEN SETUP

You have the model and skin shader in a good place to work on later, so next let's look at adding hair into the scene. For this you will be using XGen's Interactive Grooming Tools which are so easy to set up, yet they give you so much control over how the hair falls. To begin with you need some base models to add the hair to, so duplicate the main model three times calling them Eyelashes, Scalp and Eyebrows. Next, delete all the extra geometry from each model so you are only left with the areas that will hold the hair.

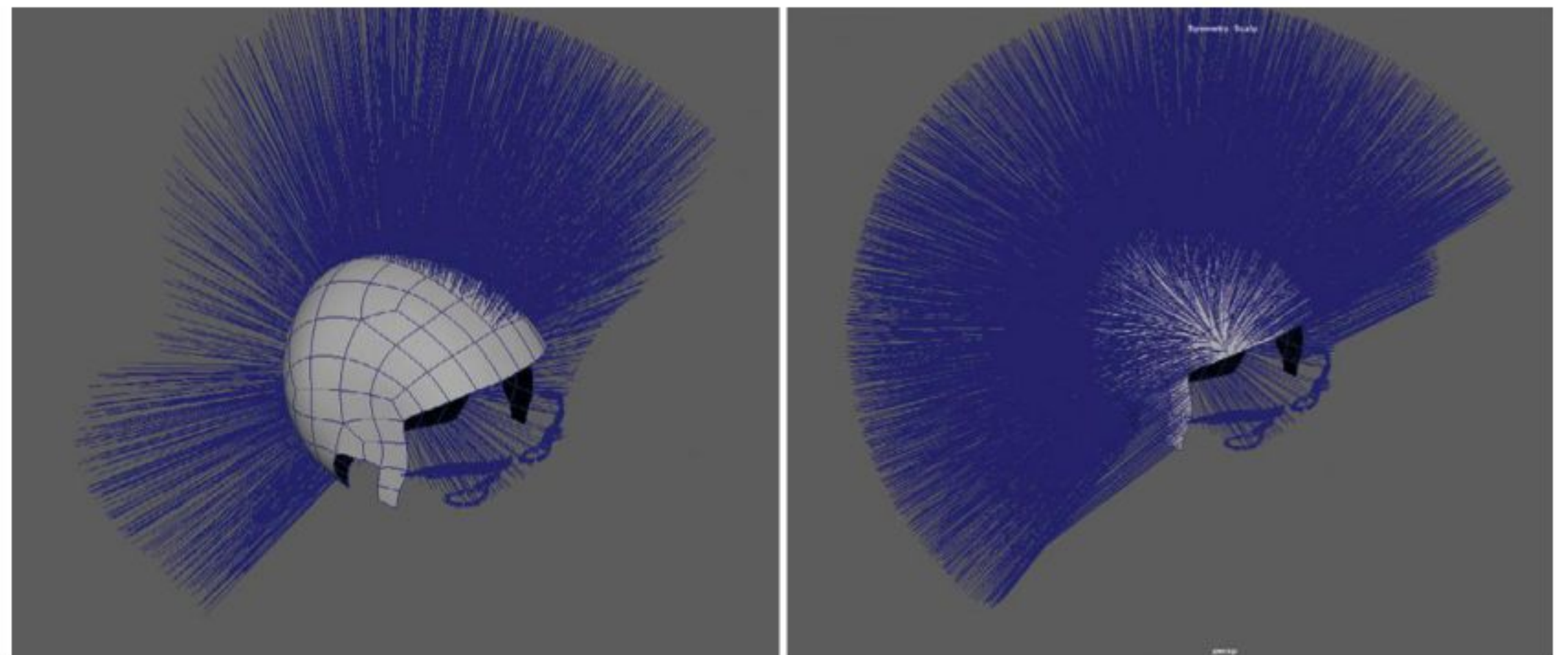
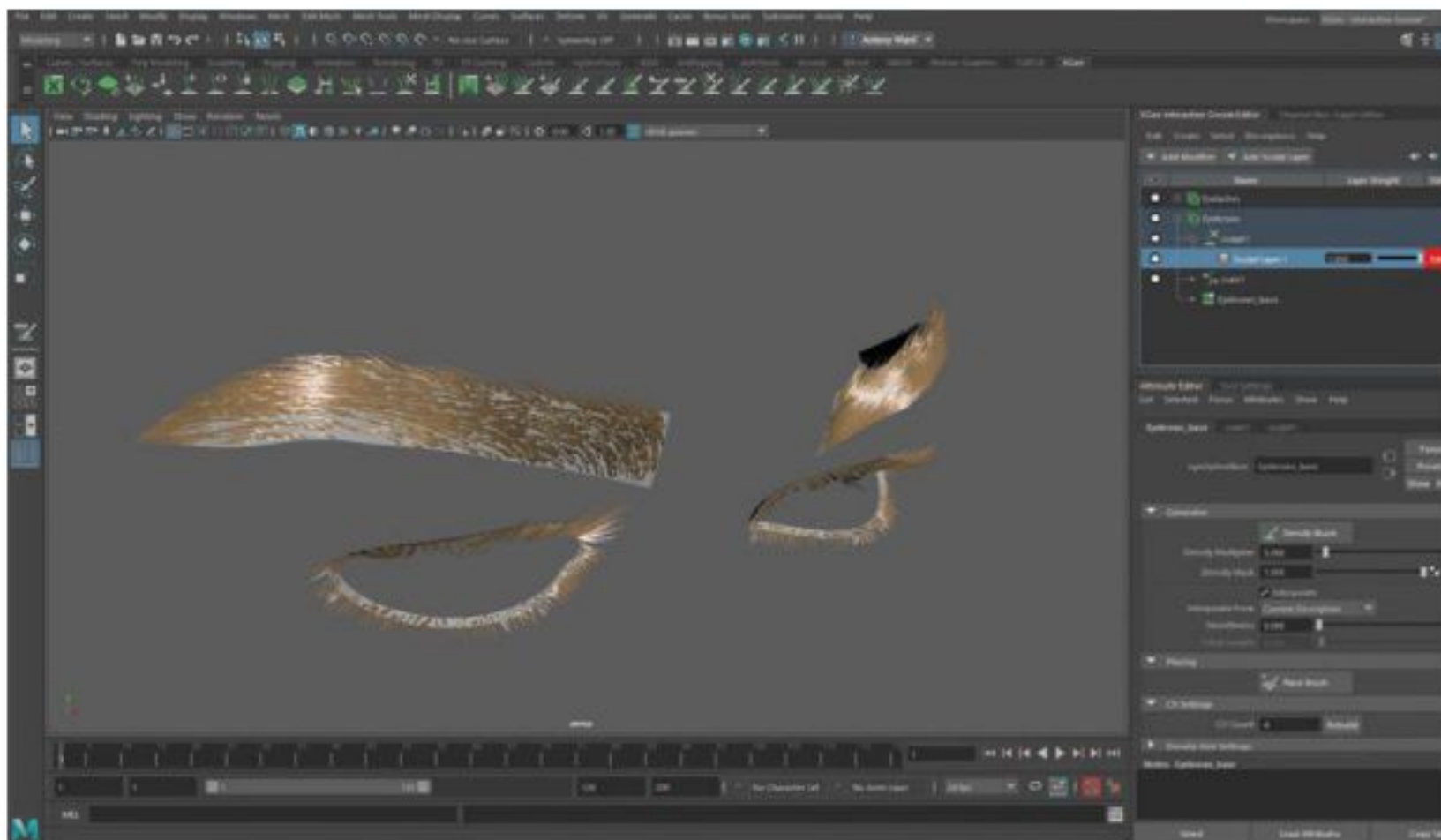


19 XGEN EYELASHES

Select the eyelash model and go to Generate>Create Interactive Groom Splines and open the options. Give the description a name and set Density to 10, Length to 1 and CV Count to 4. To make things easier change your Workspace to XGen – Interactive Groom so you have all the correct windows open. Make sure the Edit button next to the sculpt layer is red, so it's active, and then use the Comb tool and the Grab tool to adjust how the eyelashes fall. I use the Comb tool first, to maintain the nice curve.

20 LENGTHEN AND TAPER

Next, use the Length tool to make the upper eyelashes longer. You can use the Smooth tool to soften them and even them out. Change the Taper attribute on the Eyelashes node to 1. You can also fill them out more by selecting the Eyelashes_base node and changing the Density attribute. Don't worry if they look a little rough, they will be softened when it comes to rendering.

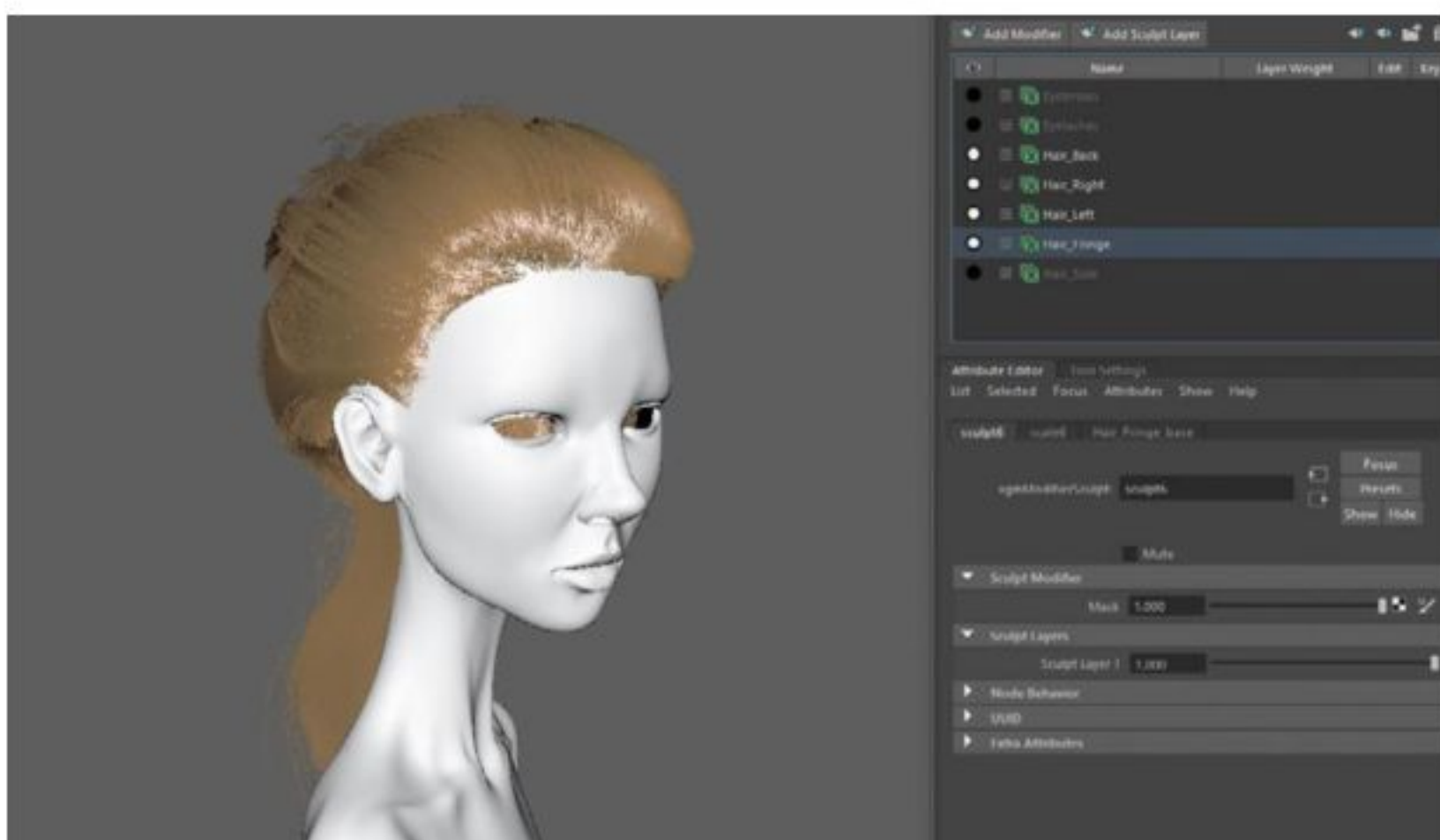


21 ADD THE EYEBROWS

When it comes to the eyebrows you can follow the same process, except this time use the eyebrow geometry as the base. Create the Interactive Groom Splines and then use the Comb tool to pose them first. As well as also using the Grab tool to help position the hairs, you can also use the Density tool to thin out the hairs towards the tips.

22 PREPARE THE HAIR

The hair in the concept is a bit more complicated than the other elements in the scene, so needs a different approach. You have the scalp model, but rather than apply the grooming splines to it you're going to divide the hair into workable sections. Don't worry, you don't need to break the scalp model up, you can just select the polygons of each region. Do that next so you have sections for the back, left, right, the fringe and the side of the scalp near the ear and create Grooming Splines for each.



23 STYLE THE HAIR

You can now use the Interactive Groom Editor to control each section of the hair's visibility. Go through and use the same tools you have for the eyelashes and eyebrows to pose each section of hair, making sure to always select the correct sculpt layer. Use the Comb tool to get the initial pose before turning to Grab to move the hairs around. Use Smooth if areas get too messy.

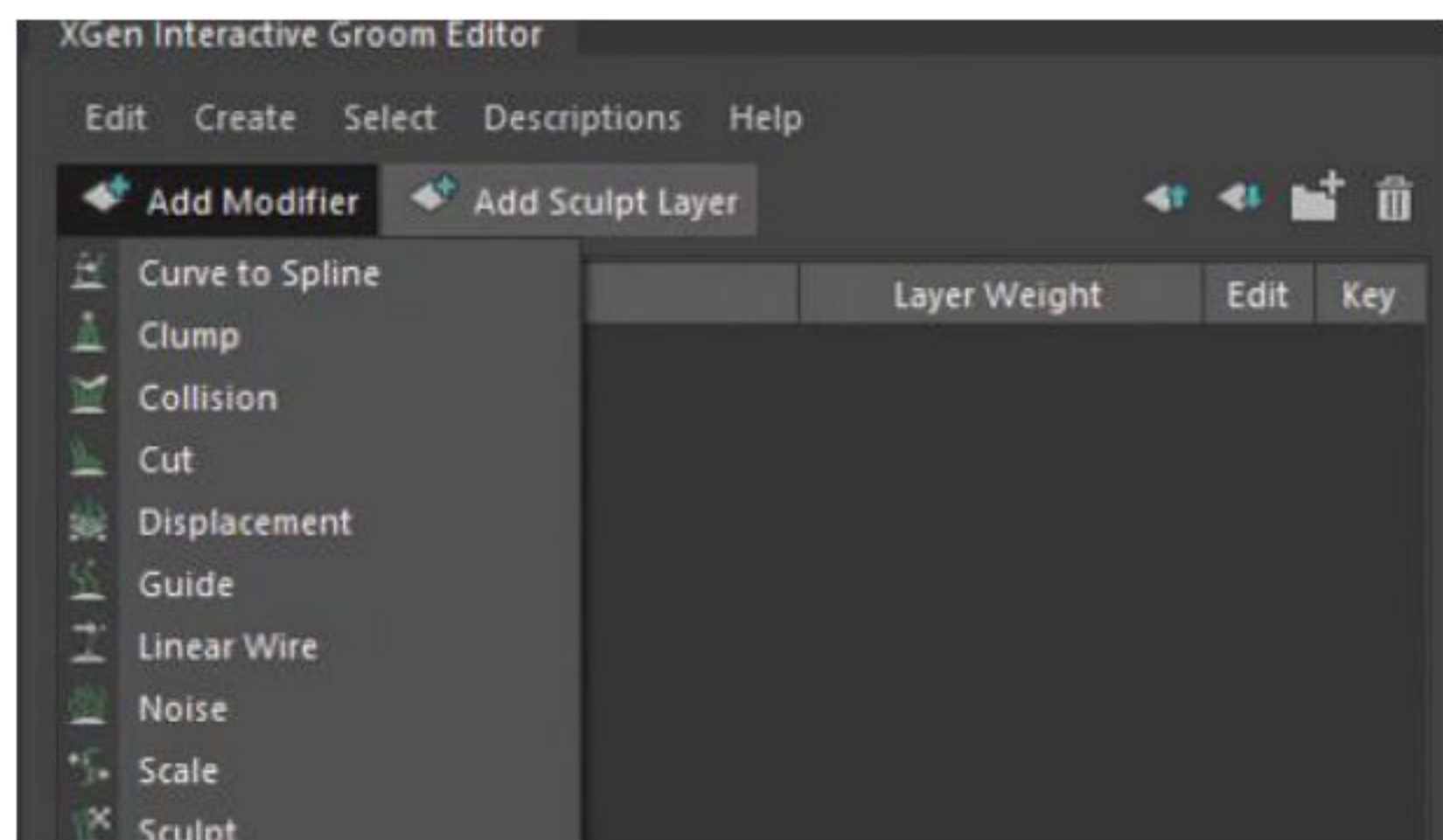
24 FREEZE REGIONS

While you're working on the hair you may find that, on the same region, you want to edit one area without affecting the other. To do this you can use the Freeze tool which will turn selected hairs blue, indicating they are frozen and won't move. You can then safely edit the other hairs around it. This is perfect for areas where you need a few clumps or strands to hang free.

Great model and texture resource
A website I have used many times in the past for great base models and unfolded textures is 3dscanstore.com. They have frequent sales too, so they are worth following on social media.

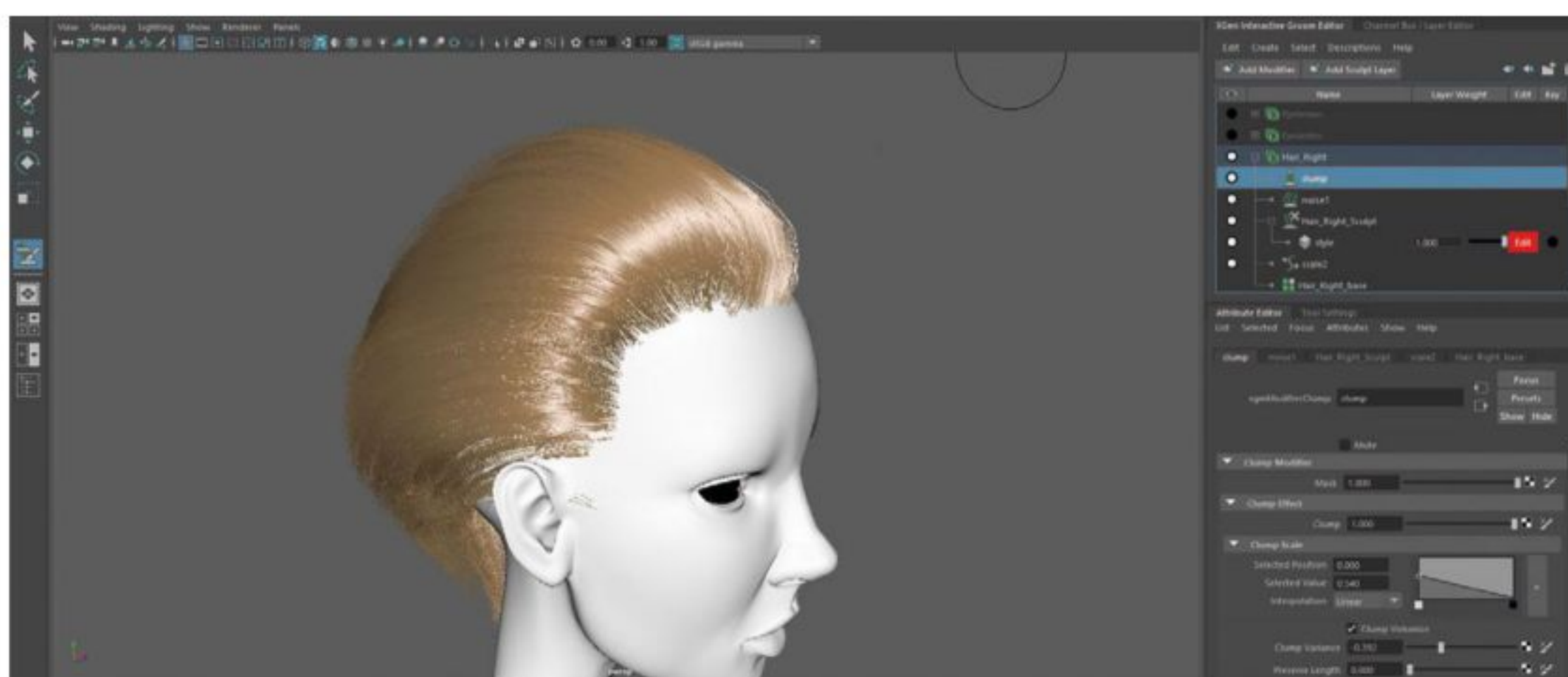
TUTORIALS

Recreate a stylised portrait in 3D



25 HAIR MODIFIERS

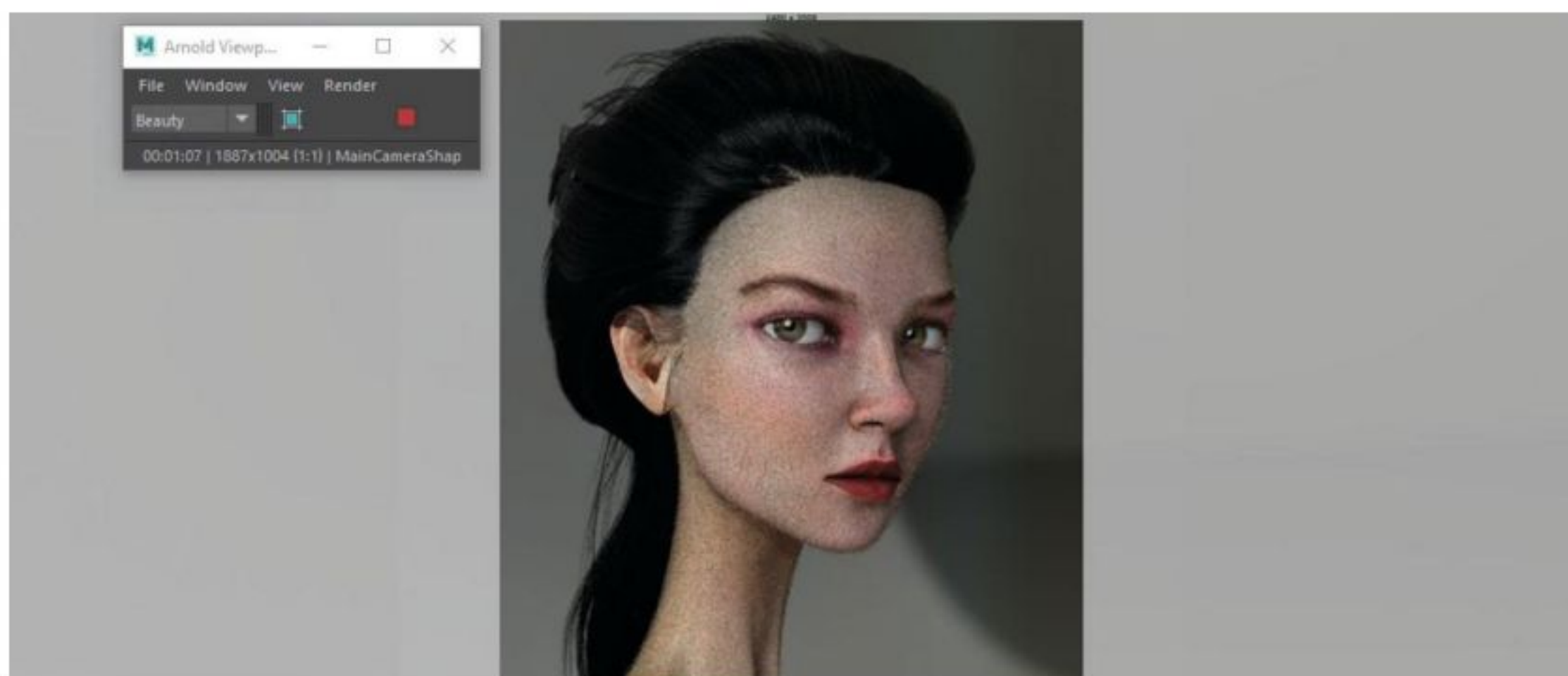
The hair will still look a bit flat and linear. In addition to all the other tools at your disposal when it comes to styling hair, you also have a series of modifiers that you can apply to each description. In the Interactive Groom Editor click the button near the top labelled Add Modifier. This brings up a list of the ways you can influence or change the way the hair looks.



26 NOISE AND CLUMPING

Select the right side of the hair you've been working on and then hide the rest of the sections for now. Now that you can see it isolated, it is looking too linear.

Click the Add Modifiers button and add a Noise and a Clump modifier. In the Attribute Editor below you will see the various options that you can play around with to adjust the frequency and magnitude to give you more variation in the way the hair falls.



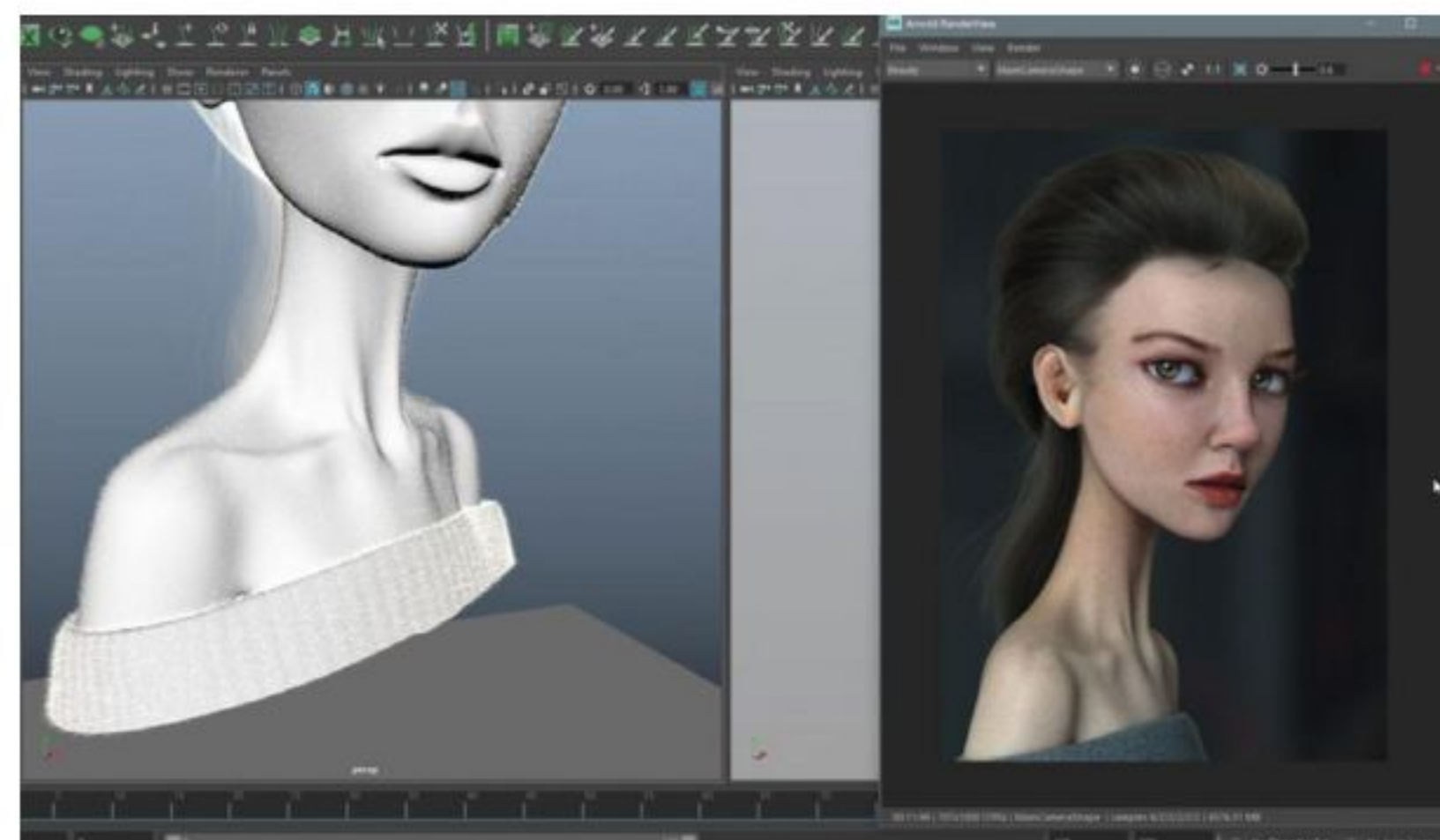
27 PEACH FUZZ

There's one more area of hair you need to add and that's what's known as peach fuzz. It's basically all the tiny hairs you have all over your body. To add this effect, apply another set of Interactive Groom Splines to the head but make sure you avoid the lips and eyes. Keep these short and thin and use a noise modifier to make them a little more random in appearance.

28 HAIR SHADER

The default shaders created when you added the hair are a little basic, and it makes sense, as we are rendering with Arnold, to use an actual Arnold shader. In the Hypershade, create an aiStandardHair node and apply it to all the sections of the hair. Leave the eyelashes, eyebrows and fuzz for now as they will need separate shaders.

By default the hair is black and looks quite thick and dense, but already the lighting is more subtle.



29 HAIR COLOUR VARIATIONS

Just like with the aiStandardSurface shader, the aiStandardHair shader comes with some preset colours that you can quickly apply to your hair to get a good starting point to work from. Choose dark brown as the starting point for this portrait, which initially is far too dark – reducing Melanin to 0.3 will brighten it up. Also reduce Melanin Redness to 0.3 and then change the Base Color to a medium grey, to darken the hair overall. Now play around with the Roughness attribute to get the right amount of sheen. Around 0.3 again should be good.

30 BUILD UPON THESE FOUNDATIONS

You now have all the elements in place. The model, lighting and textures are in and working, plus you have the shaders set up for the skin and the hair. All you need to do now is add shaders to the eyebrows, eyelashes and the fuzz, but make sure the fuzz is white and almost transparent. Play around with the shaders and experiment to see how much further you can push the scene. •



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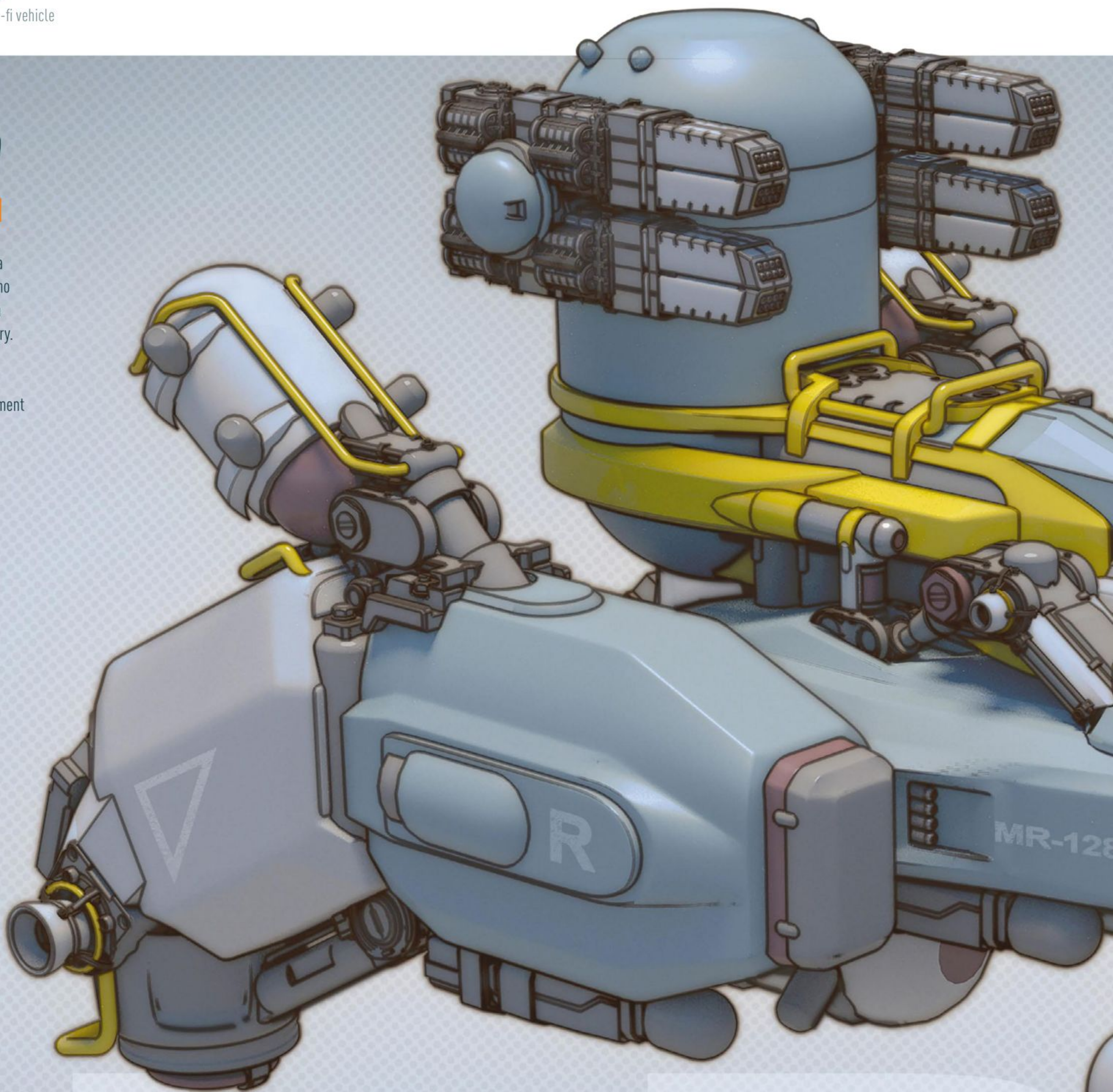
Cel-shading a sci-fi vehicle



AUTHOR

Haimeng Cao

Haimeng Cao is a concept artist who works in the film and game industry. His expertise is designing highly realistic environment concept art. artstation.com/haimengcao



3DS MAX | V-RAY | PHOTOSHOP

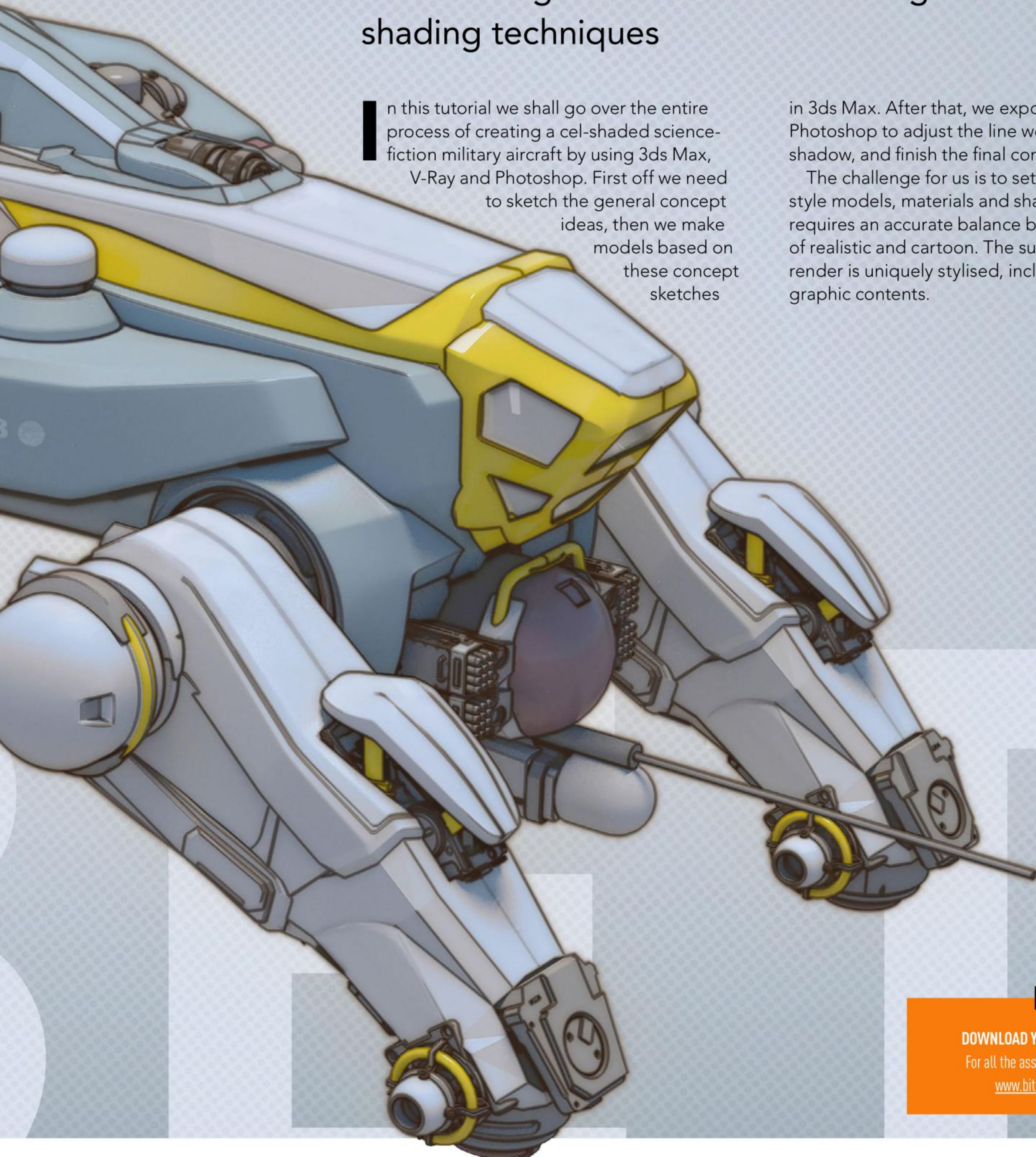
CEL-SHADING A SCI-FI VEHICLE

Learn how to create a science-fiction military aircraft for games or animation using cel-shading techniques

In this tutorial we shall go over the entire process of creating a cel-shaded science-fiction military aircraft by using 3ds Max, V-Ray and Photoshop. First off we need to sketch the general concept ideas, then we make models based on these concept sketches

in 3ds Max. After that, we export images to Photoshop to adjust the line work, colour and shadow, and finish the final concept art.

The challenge for us is to set up cel-shading style models, materials and shadows. This requires an accurate balance between the styles of realistic and cartoon. The successful final render is uniquely stylised, including interesting graphic contents. >



DOWNLOAD YOUR RESOURCES

For all the assets you need go to
www.bit.ly/3DW-254

01 THE CLARITY OF THE CONCEPT

Having a clear idea of what kind of concept you would like to achieve is always the first step. Our concept here is to design a science-fiction military aircraft, and there are several considerations such as function, style, size, crew number and structure. What kind of necessary equipment does the ship carry? What's the maximum crew number? How do those weapons work? Those specific questions support the brainstorm sketches and the direction of the project, and it ultimately helps artists to achieve a more believable design.

02 RESEARCH

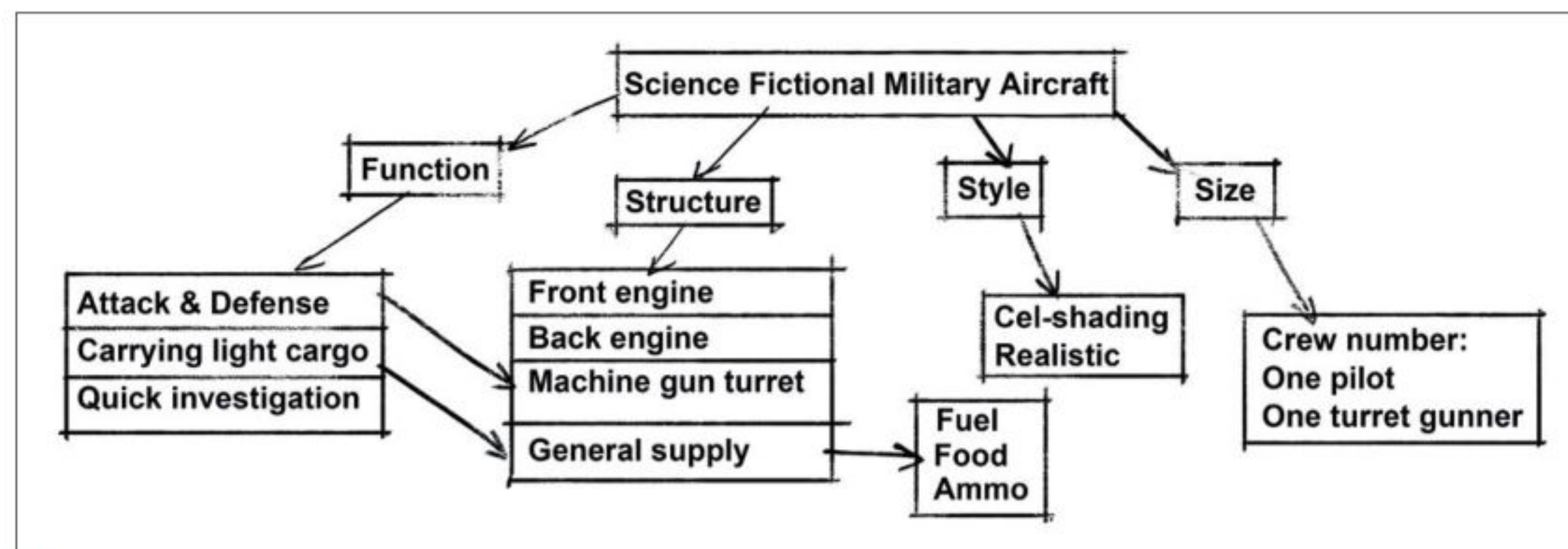
We need to find photo references relevant to our desired theme. Those references not only demonstrate the primary functions of the military vehicles and spacecraft but also indicate the potential visual forms and shapes for us to explore. For example, the cylinders and spheres as a highly symbolic visual language are functionally for the general supplies of the crew and the ammunition of weapons.

03 CONCEPT SKETCH

The brainstorm sketches are responsible for visualising those conceptual ideas we just came up with. We figure out the major form language of the ship and positions of different structures such as the turret, front engines, back engines, missile launcher and fuel supply cylinders. The turret is an interesting

Practise your sketching

Sketching ability is important for artists to develop and present their ideas. As a concept artist, it is better to have proficiency of clear, accurate and quick sketches to explore the subject matter. A tip is to carry around a handy sketchbook and do observational drawings. When we walk into an environment, we observe how people interact with the space, how architectures work with each other, and how natural light affects the mood and time. Sketching is a medium to help us think deeply.



01



02

device we may wish to explore further in the design elements – how does it open or close? What type of weapons does it carry?

04 BLOCK OUT THE GENERAL OBJECTS

In this step, we block out the general objects based on the concept sketches. A good tip is

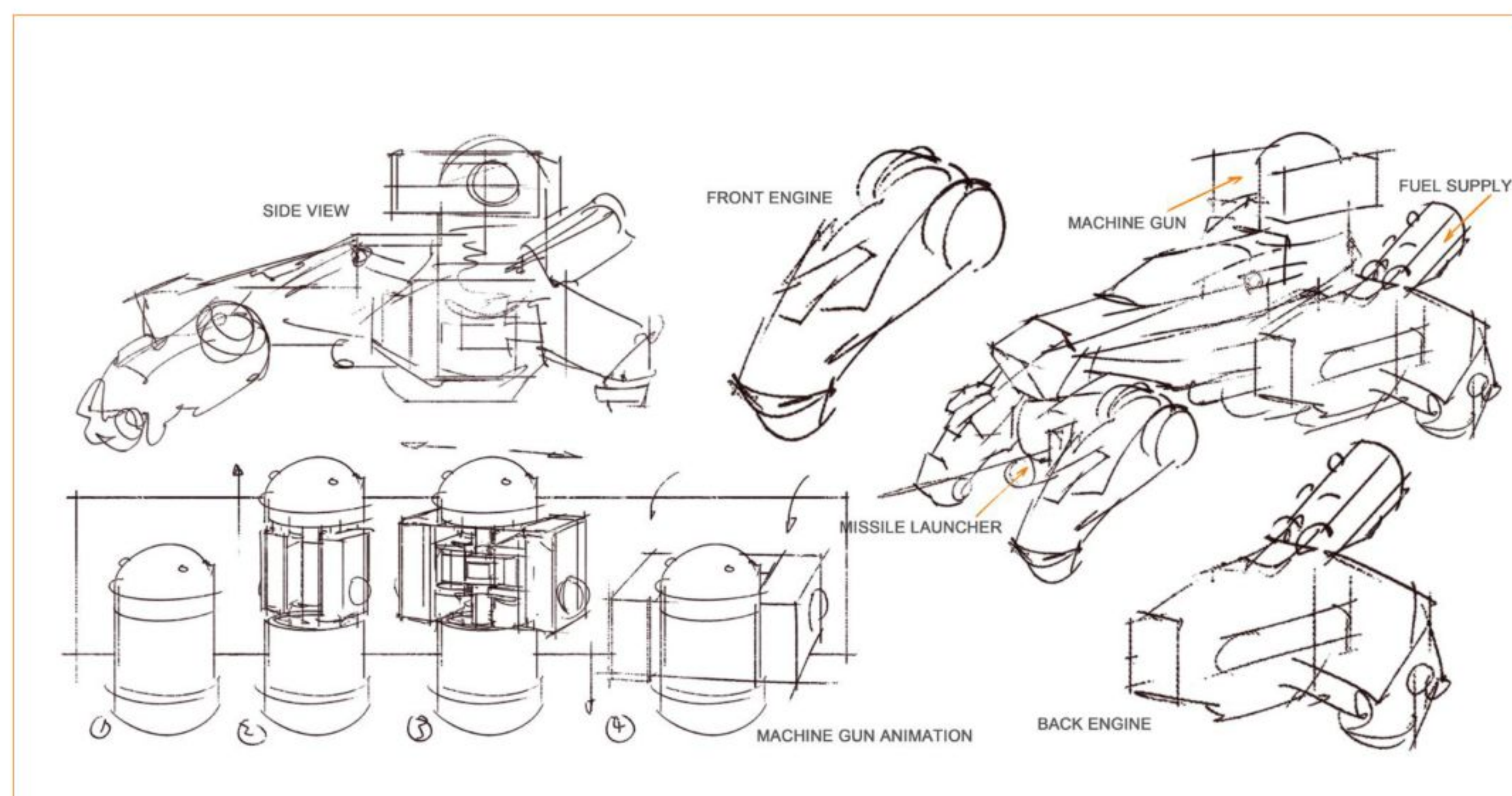
to focus on the development of simple geometries rather than designing too many details. We use a quadrangle as the basic shape and stretch it into bigger and three-dimensional objects. Keep in mind to visually compare each object and make sure that they stay within the right proportions.

05 REFINE THE INITIAL MODELLING

Quad Chamfer is the main modifier we need to use in this step. Quad Chamfer is a plugin for 3ds Max, and works effectively for hard-surface modelling. Select the edges of the objects and use Quad Chamfer to adjust the chamfer amounts of the edges. Use TurboSmooth to subdivide the objects and control the hardness of the edges. We shall keep each object's modifier histories for later adjustments.

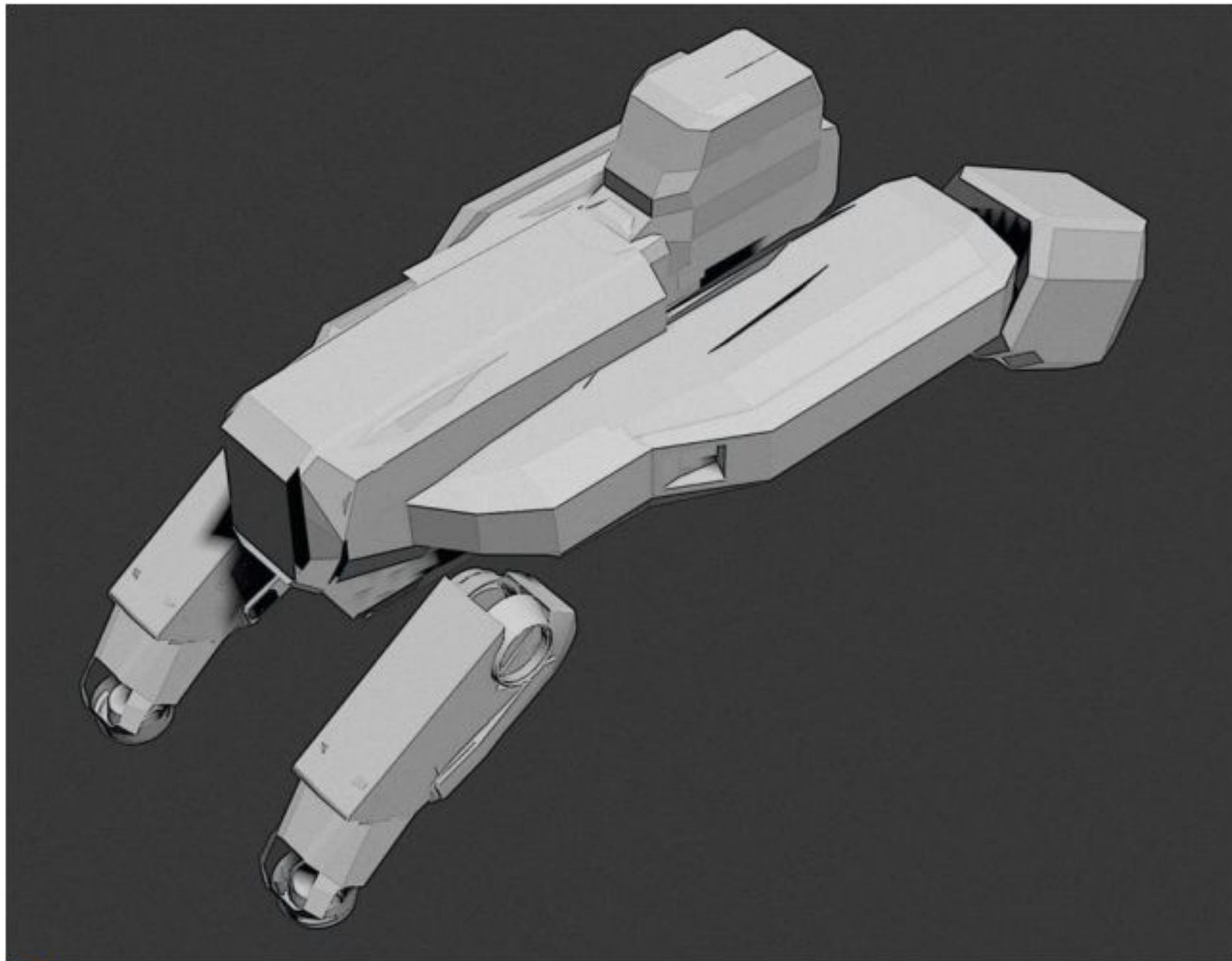
06 LIGHT

Vehicle or prop renders usually use a top light to create a soft cast shadow to visually

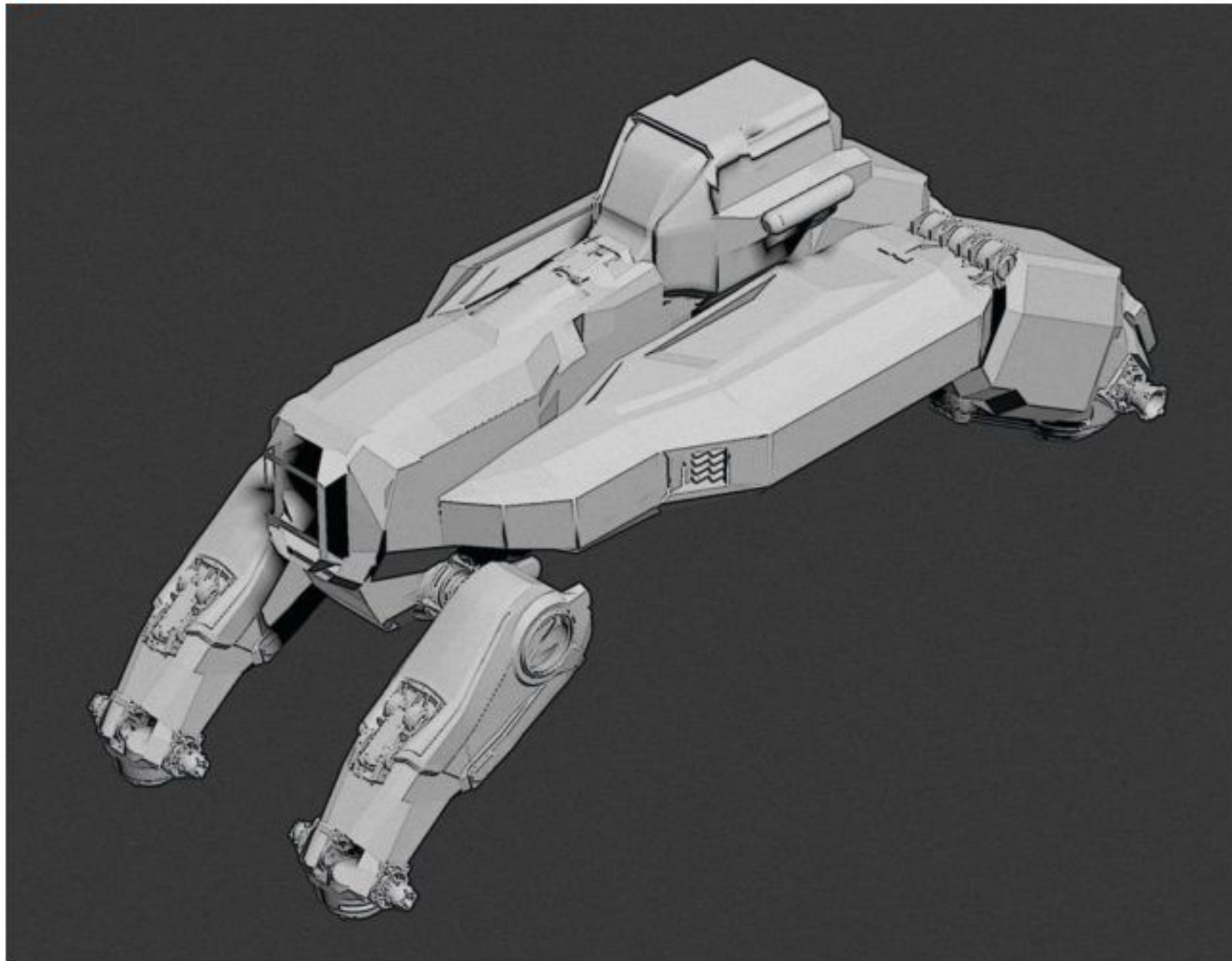


03

All images for this step: Unsplash



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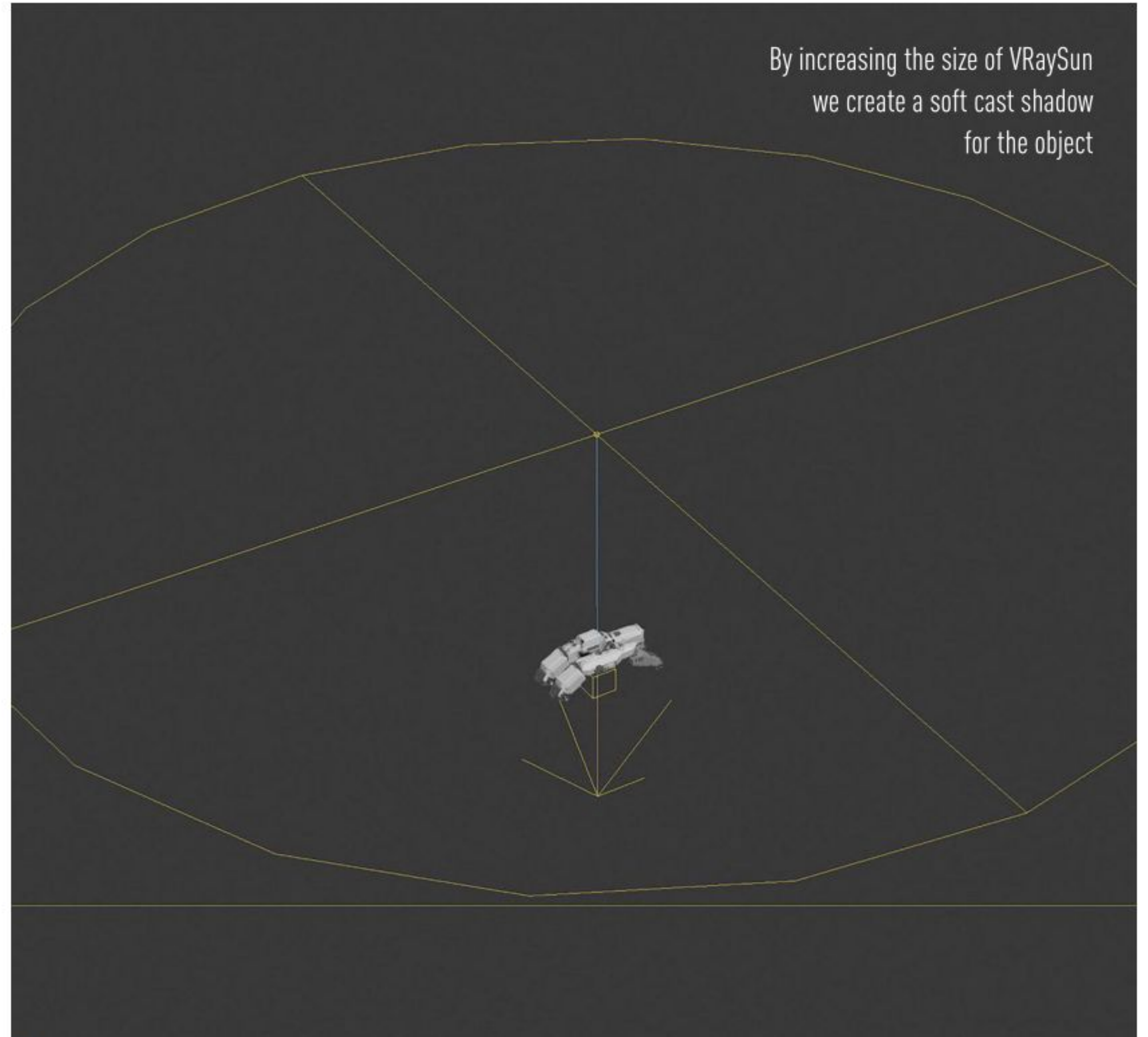
enhance the structure and design. It is good to use a single light source rather than multiple to avoid highly complex cast shadows and highlights on the materials. In this step, we set up a vertical VRaySun, and increase its size multiplier to create a soft cast shadow.

07 VRAYTOON PARAMETERS 1

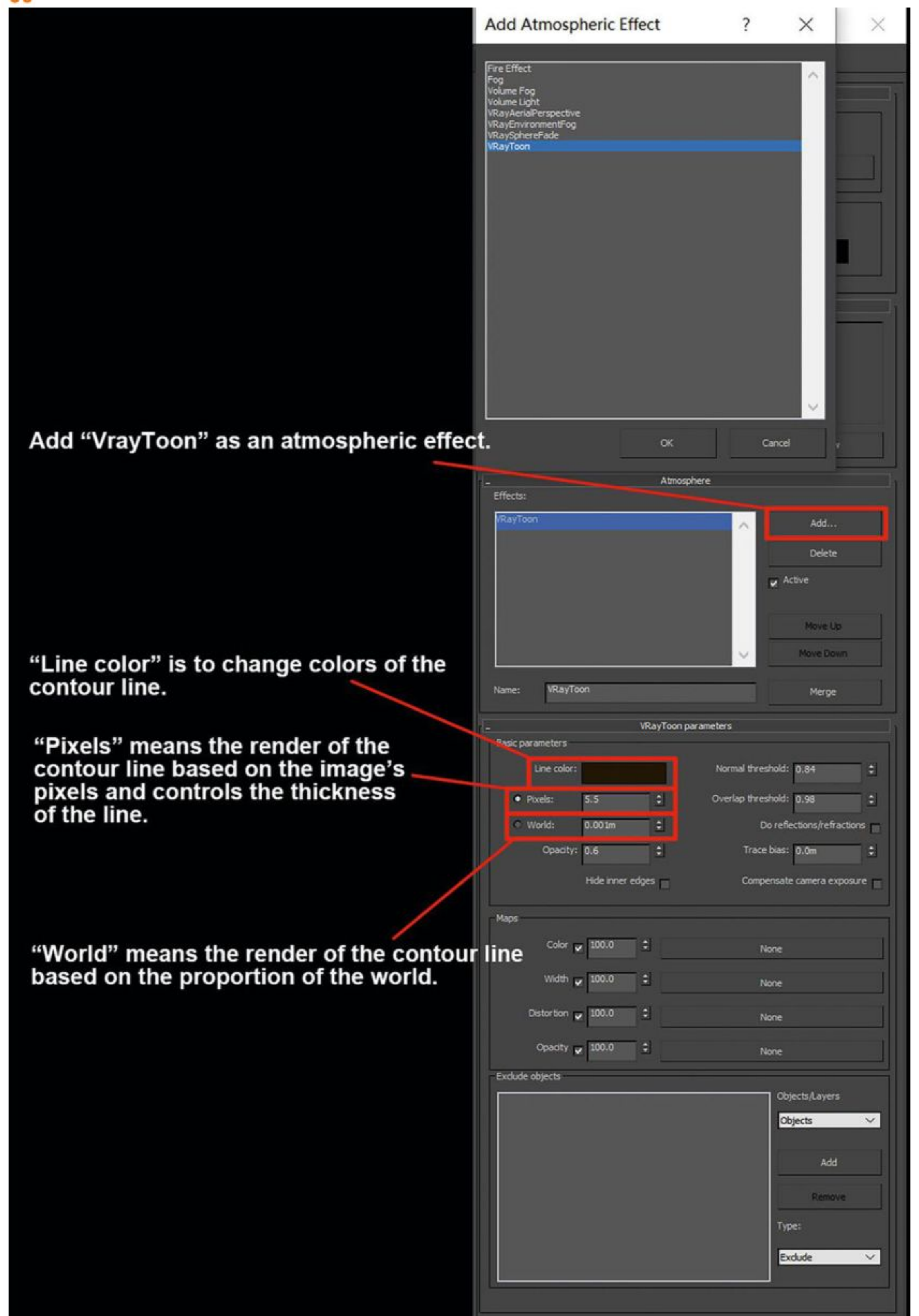
Before we start the second round of refinement, we shall finish the VRayToon settings to render a cel-shaded effect. Press the '8' key to go to the Environment and Effects panel. Add VRayToon as an atmospheric effect. In the VRayToon Parameters panel, the 'Line Color' option is to change the colours of the contour line. 'Pixels' means the render of the contour line based on the image's pixels and controls the thickness of the line. The 'World' option refers to the render of the contour line based on the proportion of the world, and 'Opacity' enables you to adjust the transparency of the contour line.

Understanding light and camera angles

No matter what kinds of art media a project focuses on, considerations of light, shadow and composition are fundamental components, and are also the key to effective storytelling.



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08 VRAYTOON PARAMETERS 2

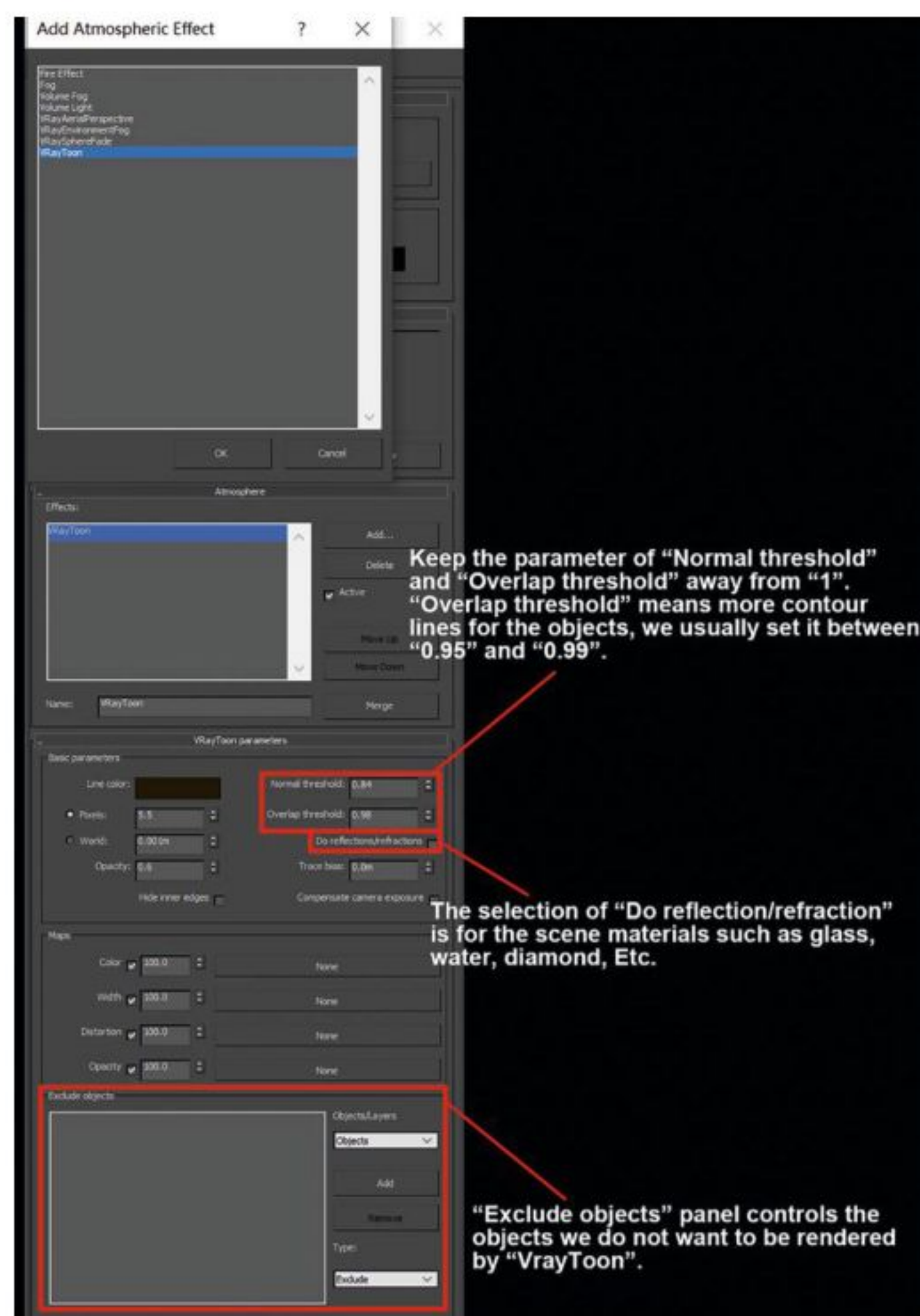
Keep the Normal Threshold and Overlap Threshold parameters away from a value of 1, or the object will be fully covered by the contour line. Increasing the parameter of Overlap Threshold means more contour lines for the objects; we usually set it between 0.95 and 0.99. The 'Do reflection/refraction' selection is for the scene materials such as glass, water, diamond and so on. V-RayToon will render the contour lines under those materials. The Exclude Objects panel controls the objects we do not want to be rendered by V-RayToon.

09 VRAY PHYSICAL CAMERA

In this step, we set up the V-Ray Physical Camera for the render. It has more complex ways to control the light and frame than the standard target camera. 'Focal length (mm)' and 'film gate (mm)' control the perspective of the view. Decrease the parameter to make a long lens, increase to make a wide lens. 'Shutter speed (1)' and 'film speed (ISO)' control the light values of the image. Lower the shutter speed to increase the light value, and heighten it to decrease the light value.

10 SECOND MODELLING REFINEMENT

In this step, we concentrate on developing more elaborate objects that particularly support the cel-shaded effect and final render. We will include more interesting details on the engines and body of the ship. Those details need to potentially harmonise with the



08

Industrial design

For work like this, a good concept artist is familiar with industrial design. For example, a design of an interstellar space ship may require the knowledge of vehicle functions, the understanding of the interior and exterior, size proportions, and may even have a familiarity with astronomy and physics. Having a knowledge of these different fields feeds the believability of the artwork.

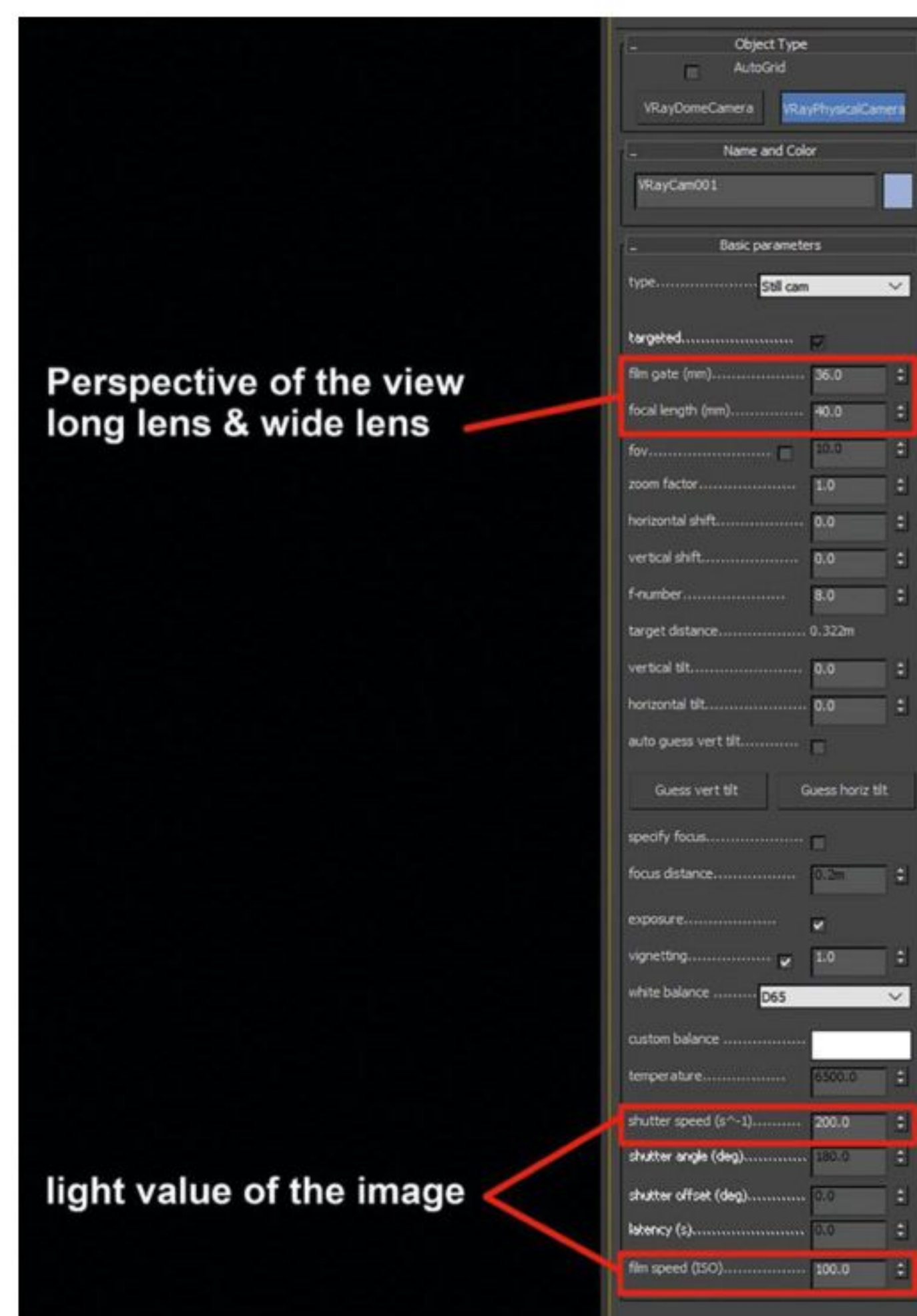
visual language (simplicity and complexity) and indicate how it works (function). We may go back to the objects' modifier histories to do more adjustments.

11 DESIGN THE TURRET

The turret of the aircraft is the focal point of the design, so we shall make it as interesting as possible. Basically, the closed turret is a simple cylinder object; the sketch demonstrates the unfolding process and the interior structure. The interior gunner may feature different types of weapons based on the situation.

12 MODEL THE TURRET

In this step, we model and render the turret by the same

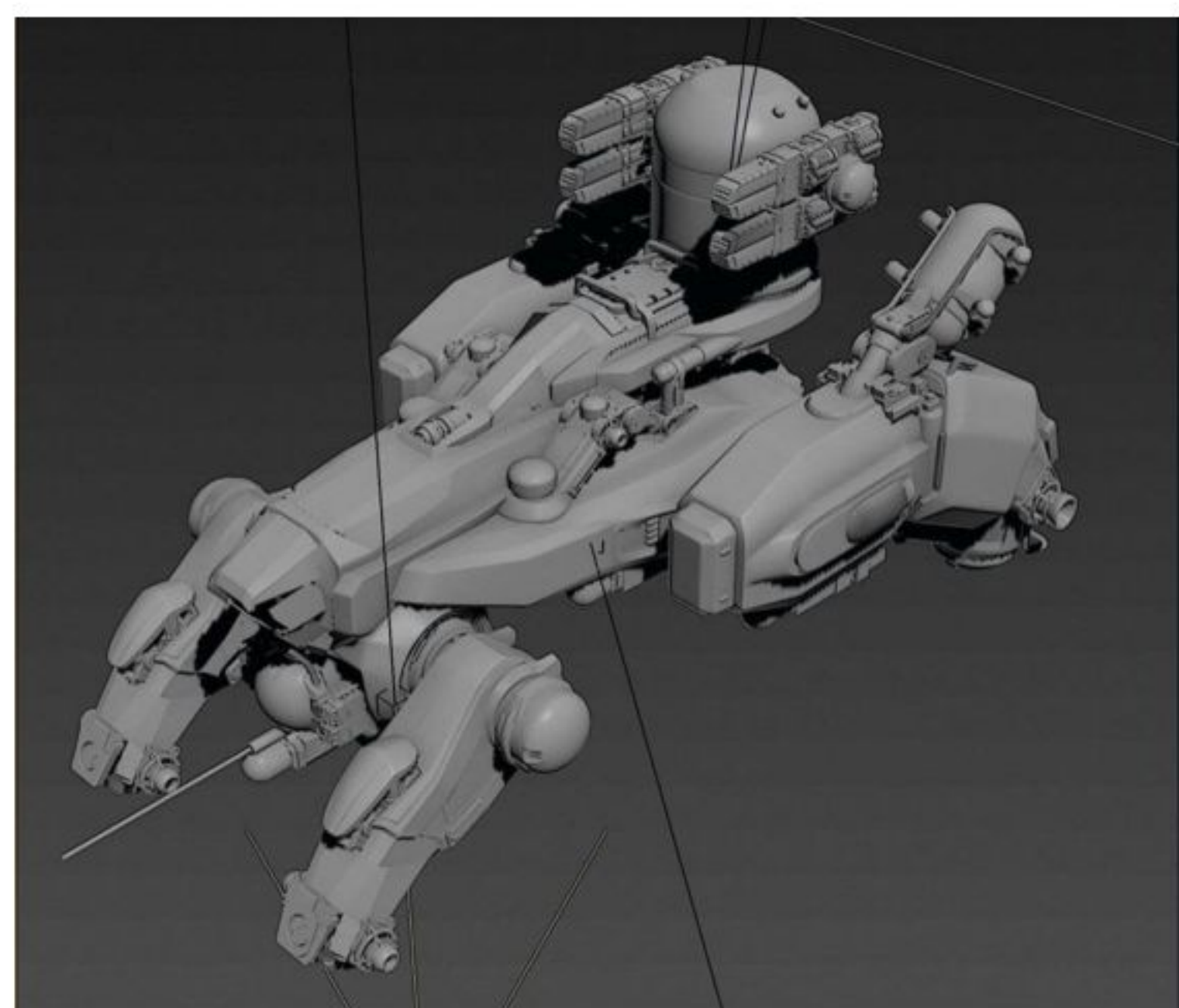


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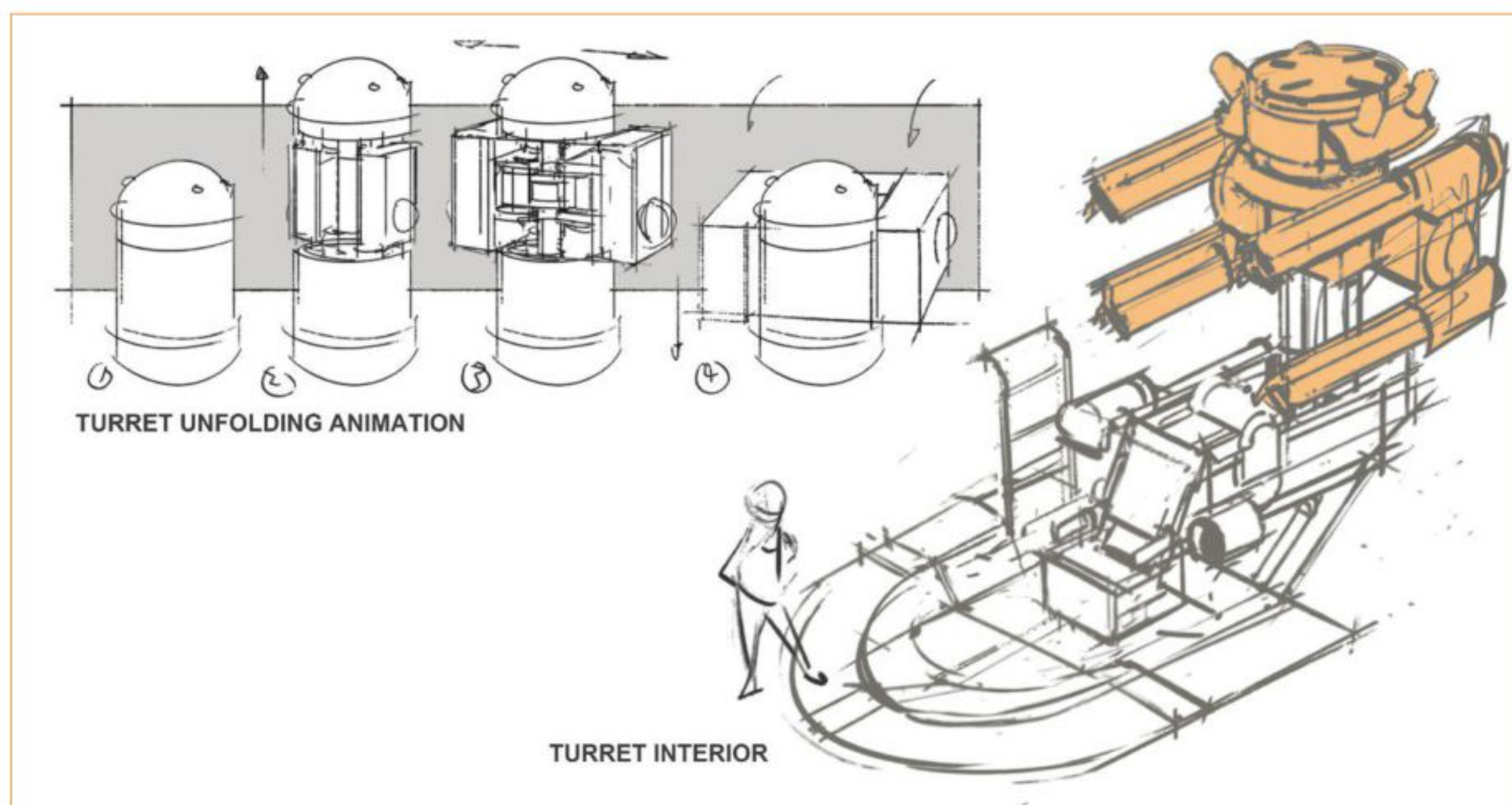
technique. There are three types of turrets: two different calibres of machine guns, and a missile launcher. The modelling style consistently follows the body of the aircraft. We use V-RayToon to render and Photoshop to enhance or weaken the contour line for the clarity.

13 MATERIALS FOR CEL-SHADING

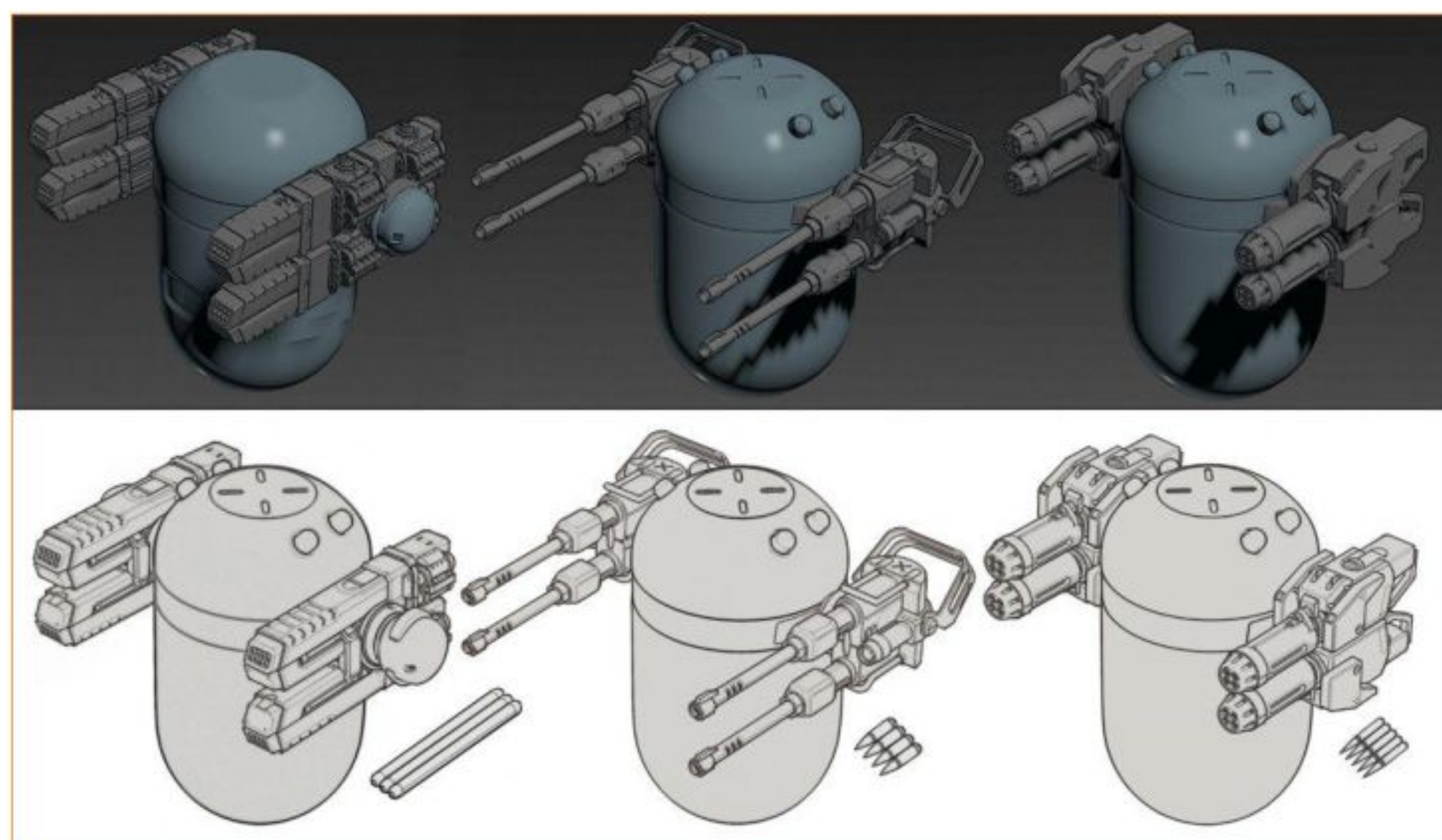
We will use V-RayMtl to set up the materials for the cel-shaded render. For concealing reasons, 90 per cent of the ship's materials should be dull polished. You can add a little bit of reflection to the material by simply lowering the Whiteness of the Reflect parameter. The HGlossiness



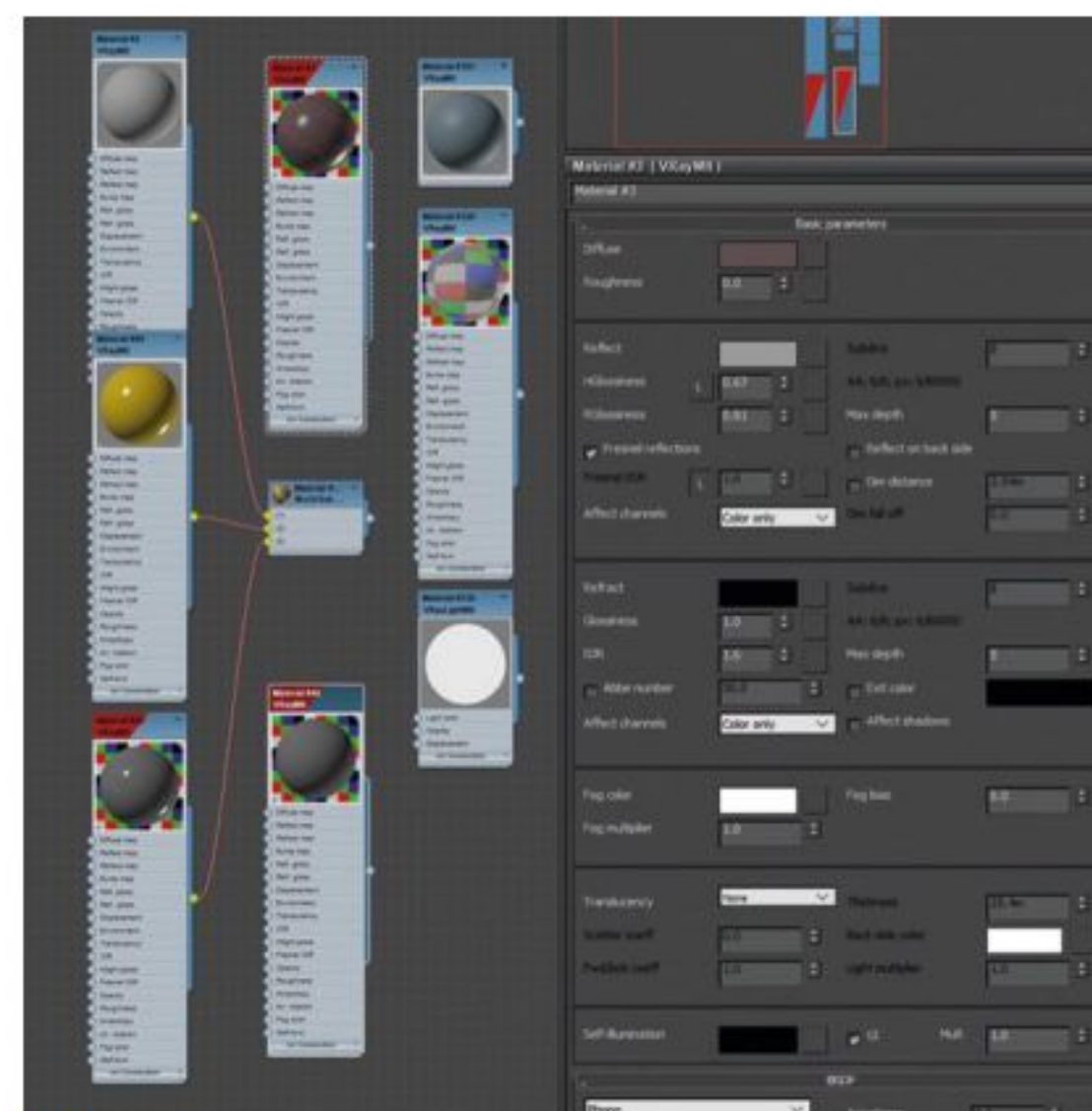
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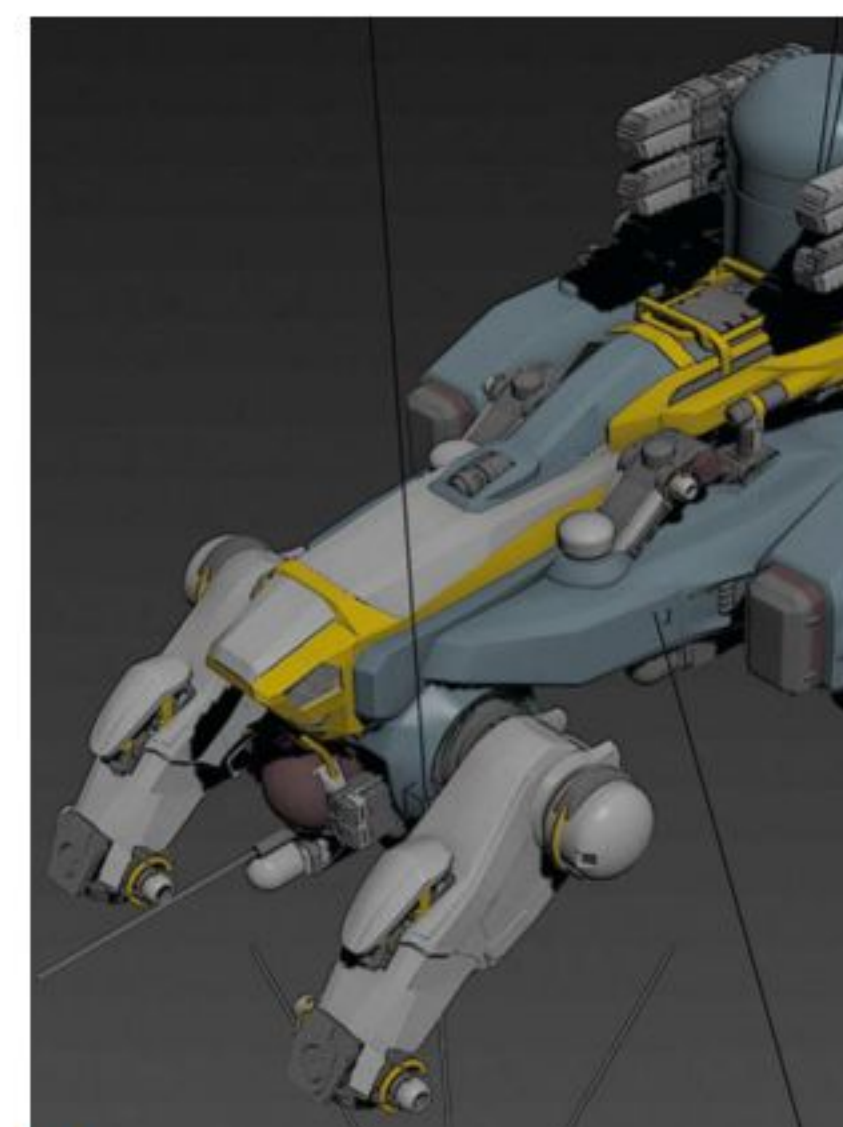
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parameter controls the highlight size of the materials, whereas RGlossiness controls the surface reflection clarity of the materials. We lower them both to remove strong highlights and blur the surface reflection.

14 COLOUR We are using cool blue as the main colour for the ship, while white works for the shells of the engines and control room, and yellow for the metallic beams and supports. We reduce and darken the saturation and value of the red. The dark red works well for the indication of the cylinders.

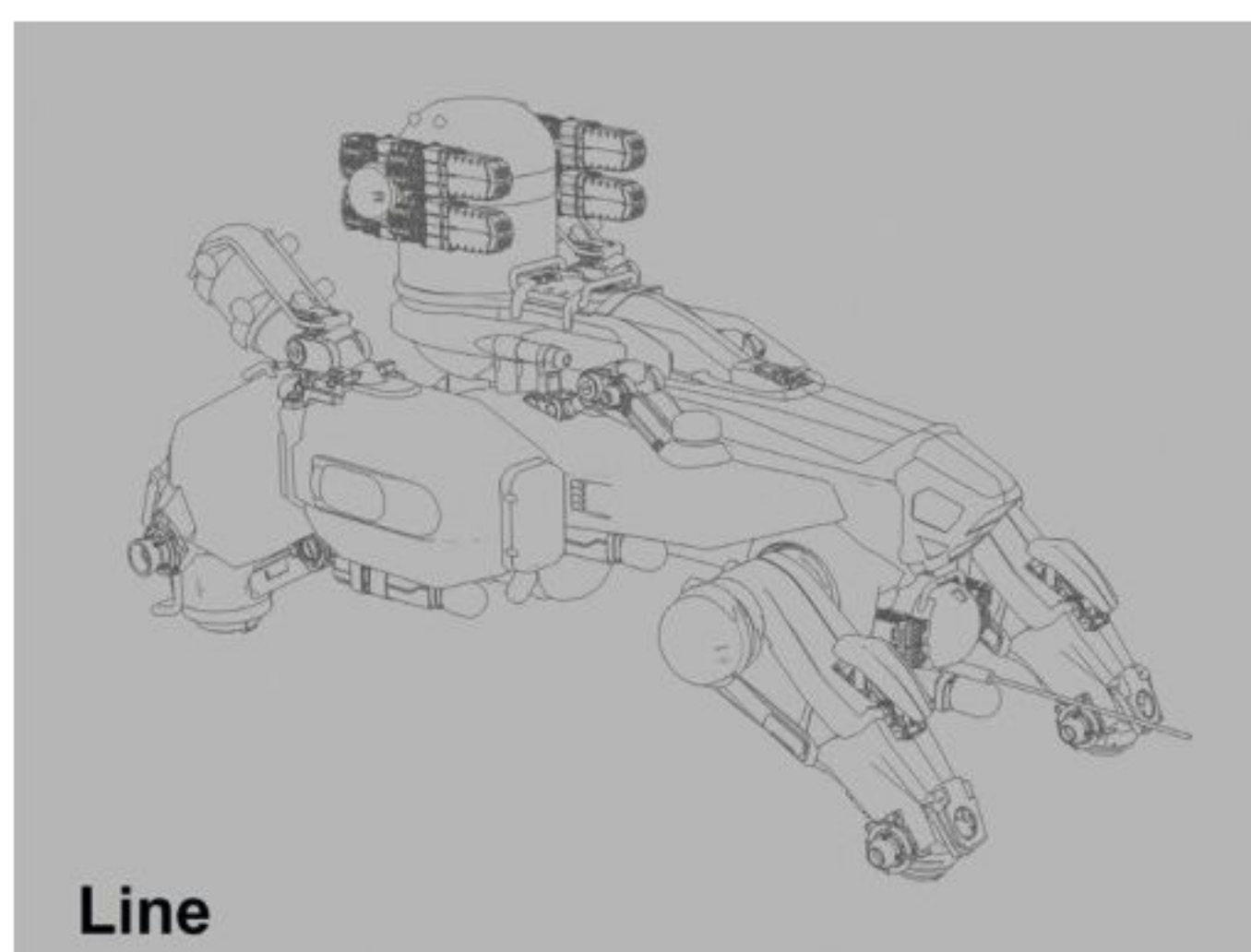
Composition
Good composition usually has a clear visual information hierarchy. The focal point of the image is on the top of the hierarchy and needs to be supported by the secondary visual information. Excessively interesting foregrounds or backgrounds may grab the attention, so try to reduce the value contrast and desaturate the colours.

15 EXPORT IMAGES In this step, we shall export three types of images for Photoshop and create the final image. We apply VRayLightMtl to the whole ship and render the Line image. The Color & Value image is rendered without application of the VRayToon effect. The Alpha image has the clear contour of the object.

16 OVERLAY THE LAYERS We use Photoshop to overlay three images. The purpose is to control each layer separately. The Color & Value image is the bottom layer; use the Curves to decrease its shadow value. Since the Line

image is the layer on the top, the Curves does not affect its value. The Alpha image is to help us get the accurate layer mask of the ship, so it is easy to edit the information of the background, including colours and texts.

17 FINAL ADJUSTMENTS For the last step, we adjust the highlights to be cooler by using Color Range and the Photo Filter adjustment layer. Add text to enhance the graphic effect of the image. Use the Pixelate > Color Halftone option to add an interesting comic magazine texture to the background. ●



Line

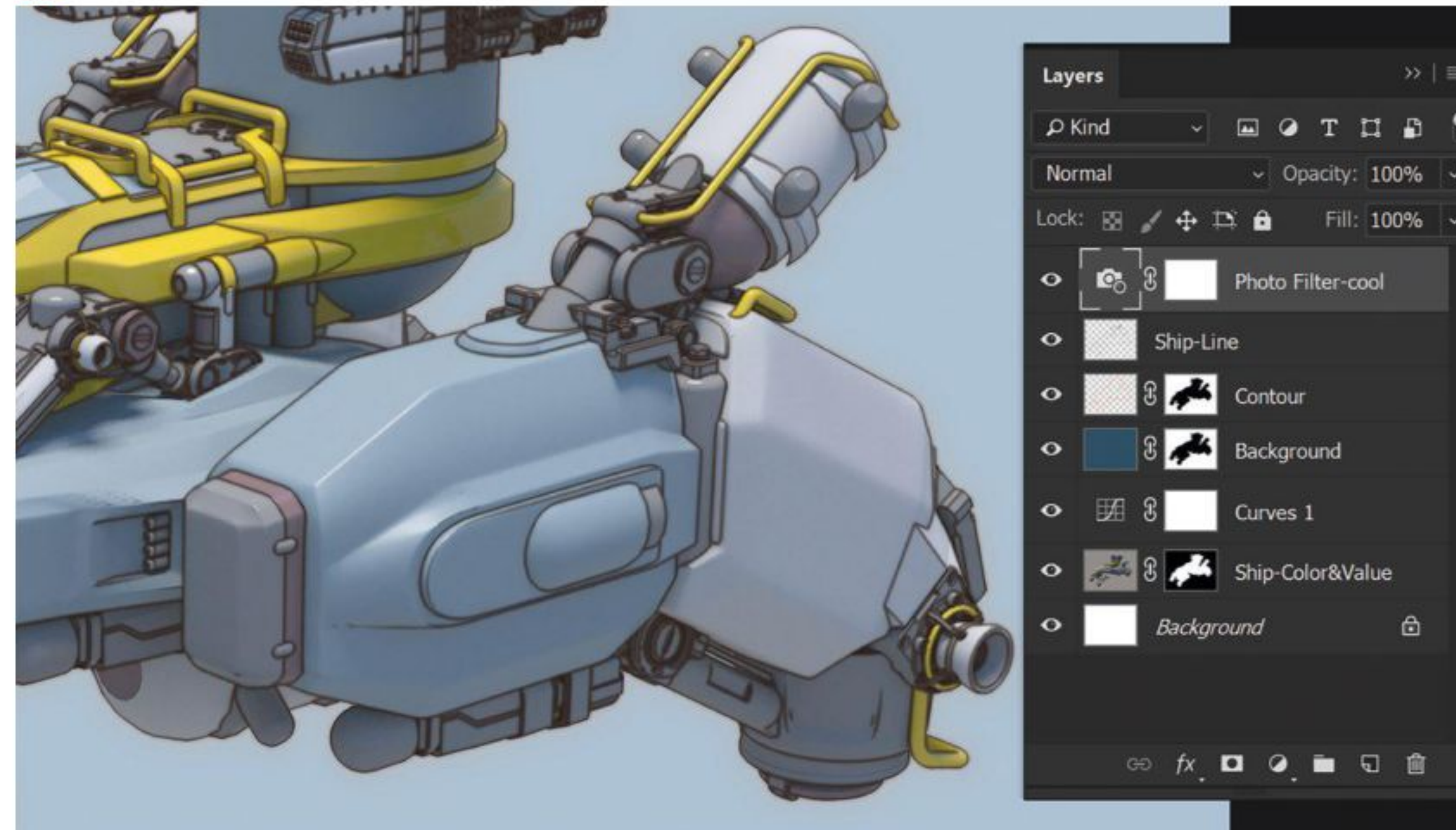


Color & Value

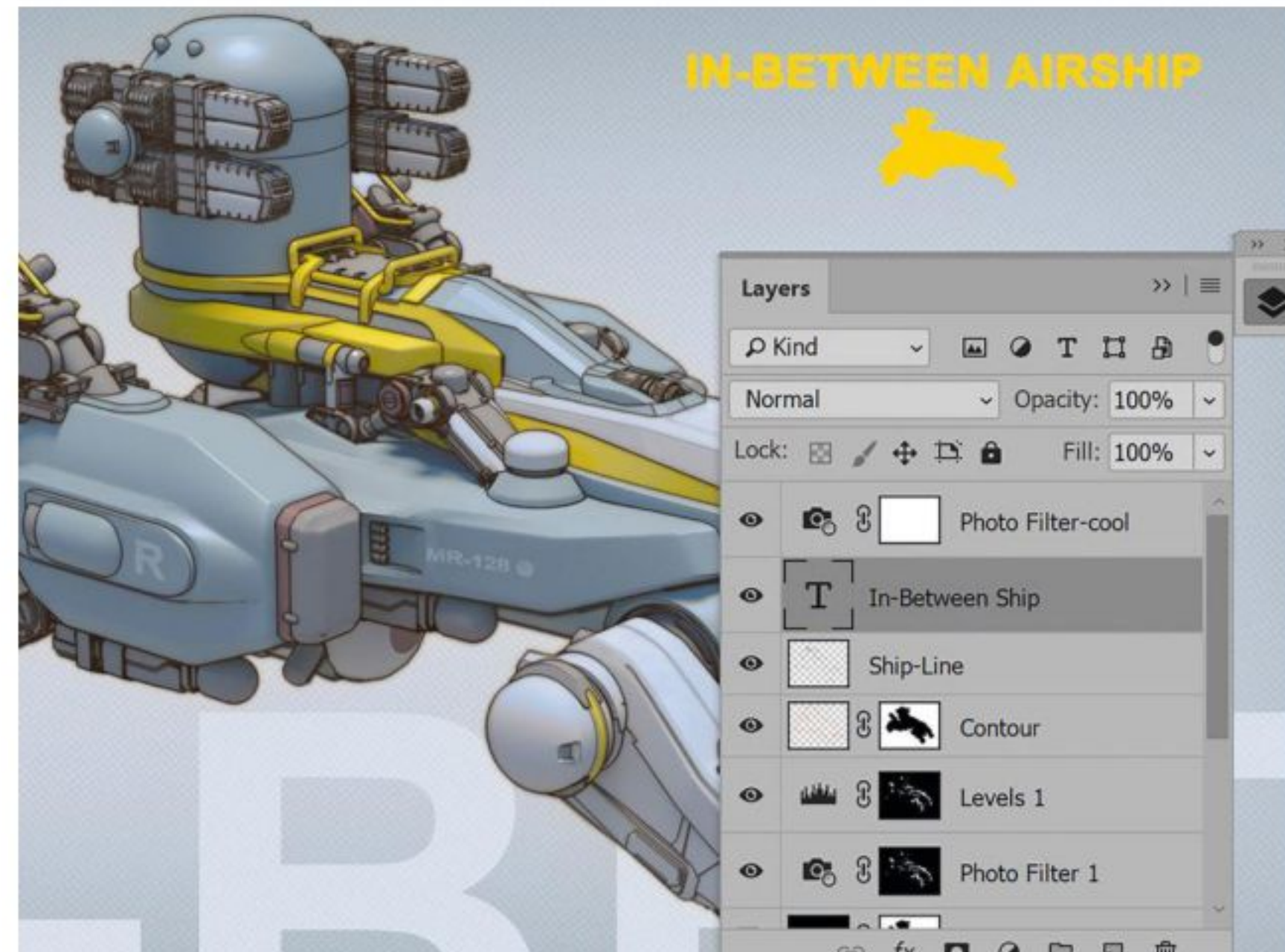


Alpha

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THE LASER COWBOY

The final scene. Original
concept by Gaspard Sumeire

BLENDER 2.80 | SUBSTANCE PAINTER 2019 | ADOBE PHOTOSHOP

DESIGN A 3D SCENE WITH BLENDER & SUBSTANCE PAINTER

Alejandro Treviño provides a step-by-step workflow for creating a 3D illustration from start to finish

I'm always on the search for incredible new stories, looking for concept art that has never been told in 3D before. I try to replicate the stop-motion style for textures and theatrical illumination, taking references from Laika Studios, Wes Anderson and Tim Burton. For this project, I focused mostly on correctly using the hair particles and the volume shader for the smoke. To render this scene it was necessary to use the new CPU+GPU rendering method in Blender Cycles for keeping the time short.

DOWNLOAD YOUR RESOURCES

For all the assets you need go to
www.bit.ly/3DW-254

01 CREATE A FOLDER STRUCTURE

Having a clear folder structure makes the process easier when you are searching for files, and will save you time in the long run. I divide my assets into six folders. The 2D folder has the alphas, sketches, final textures and vector images in SVG. The 3D folder has the Blender scene, FBX files and the Substance Painter project. The Branding folder contains the fonts, logos and ideas for social media. The Concept folder features the original concept image and photo references. The Music folder has the music for promos, and the Renders folder has the project process and final images.

02 SET THE CAMERA

Add a camera with Shift+A, select it and position it. Click on

Numpad 0 to look from inside the camera. Use N to view the Properties menu of the viewport. In the View tab use 'Lock Camera to View', to adjust the position with ease. When the correct position is reached, remove 'Lock Camera to View' so the camera freezes on that position. Also in Properties>Output>Dimensions adjust the width and height in order to match the original concept image's proportions.

03 ADD THE BACKGROUND IMAGE

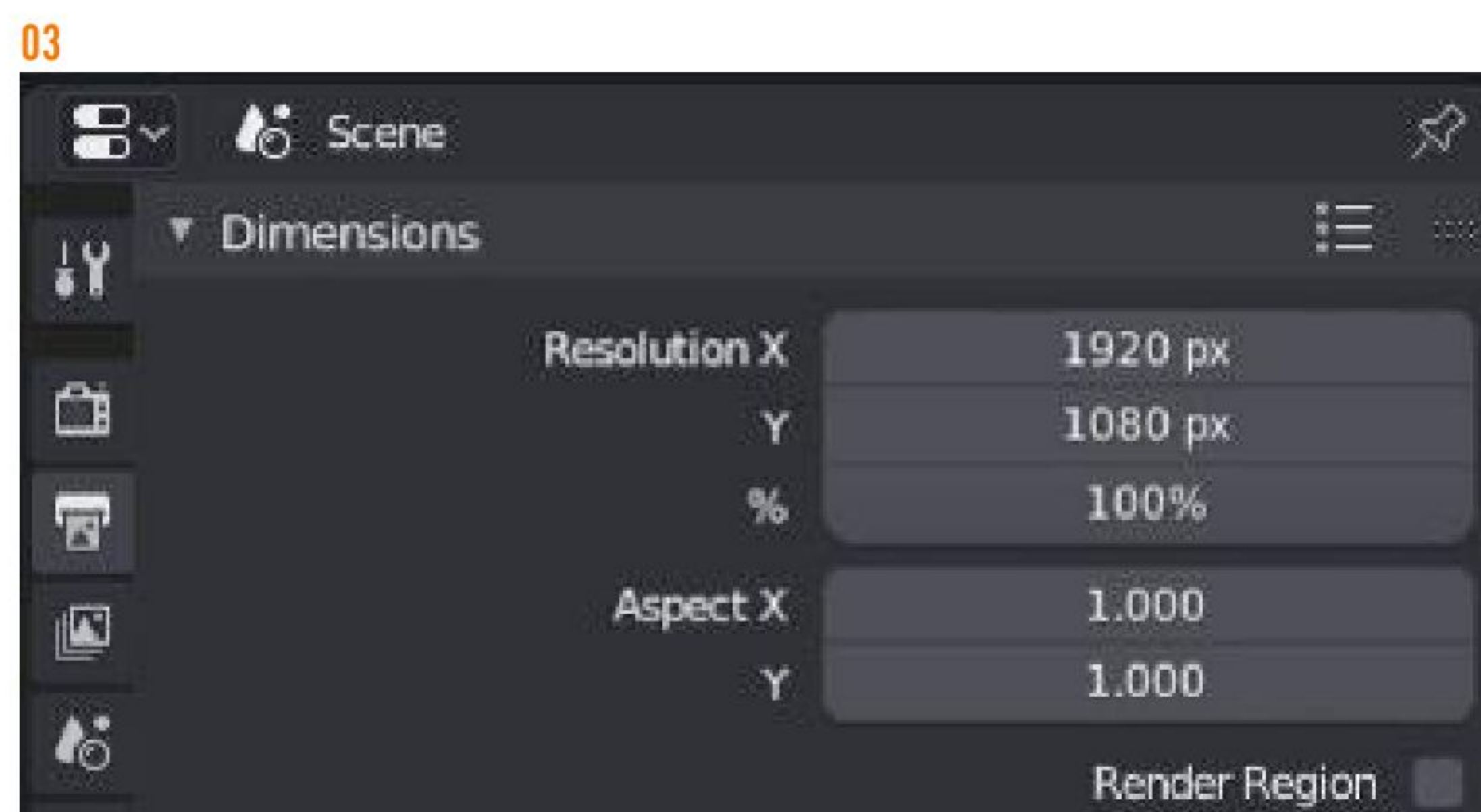
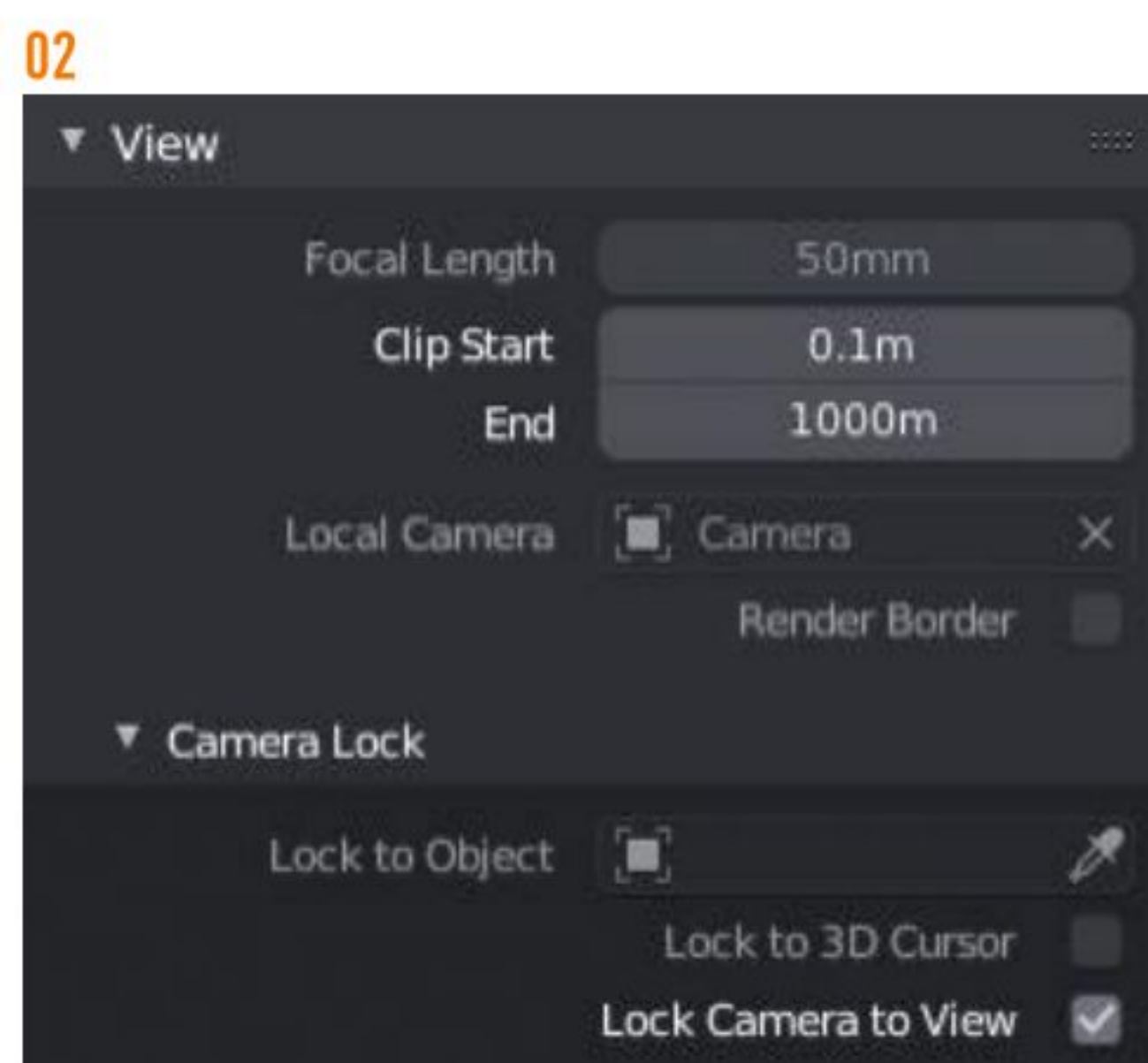
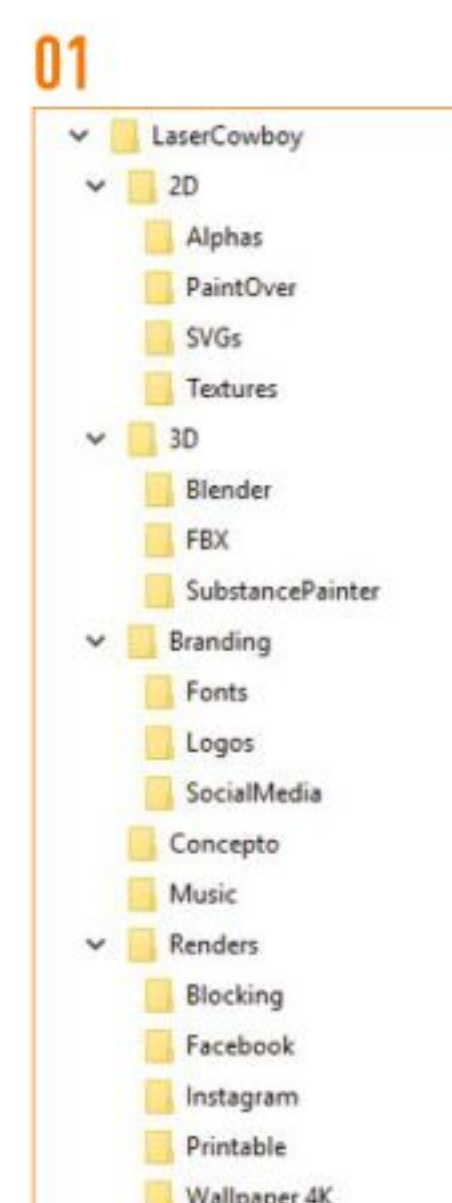
To add a background image to the Camera Perspective go to the Properties menu>Object Data (Camera), activate Background Images and click on Add Image, then select Open to choose the concept art image file. Setting a



AUTHOR

Alejandro Treviño

A self-taught 3D independent artist focused on making artwork and sharing the process for educational purposes.
aendom.com



TUTORIALS

Design a 3D scene with Blender & Substance Painter



04

➤ background image helps us with having the same proportions for every object in the scene, and gives a clear image of what is going to be inside the frame.

04 POLYGONAL MODELLING AND SCULPTING

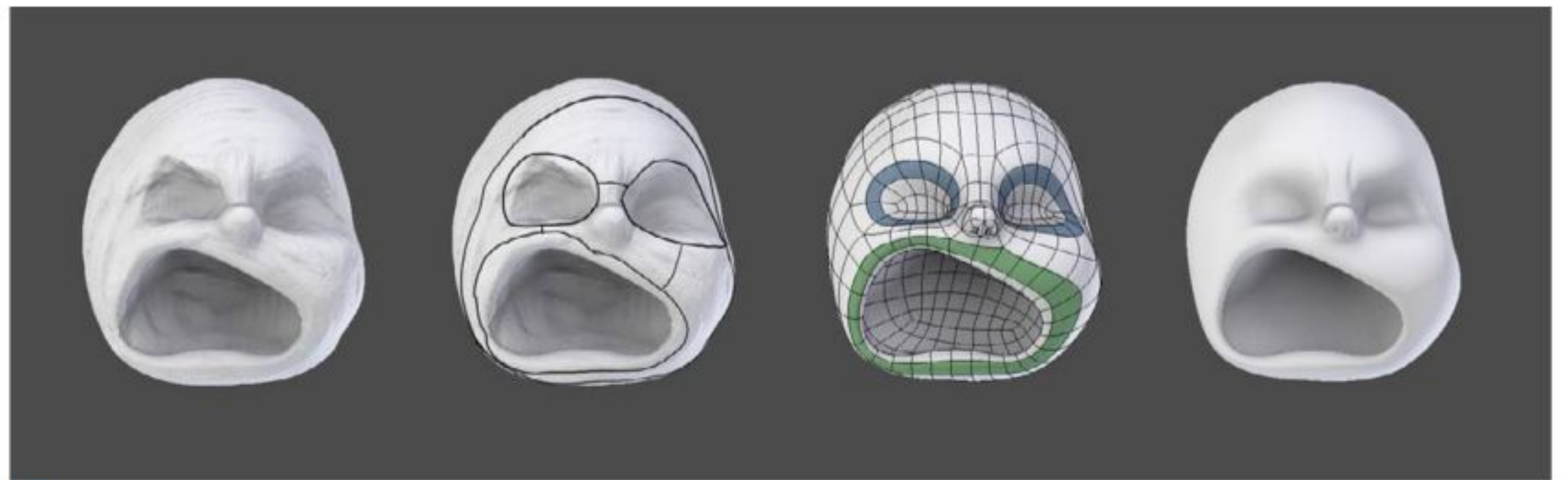
Sometimes it is necessary to combine polygonal modelling and sculpting. When the object is simple polygonal modelling is enough. But for organic forms, first make a very basic sculpture using dyntopo, then do a retopology and use the Multiresolution modifier to sculpt the final details. In the modelling phase these three modifiers are the ones I use the most: Solidify to give thickness to planes, Subdivision Surface to subdivide the model, or Multiresolution also to subdivide but with the ability to add details in Sculpt Mode.

05 RETOPOLOGY

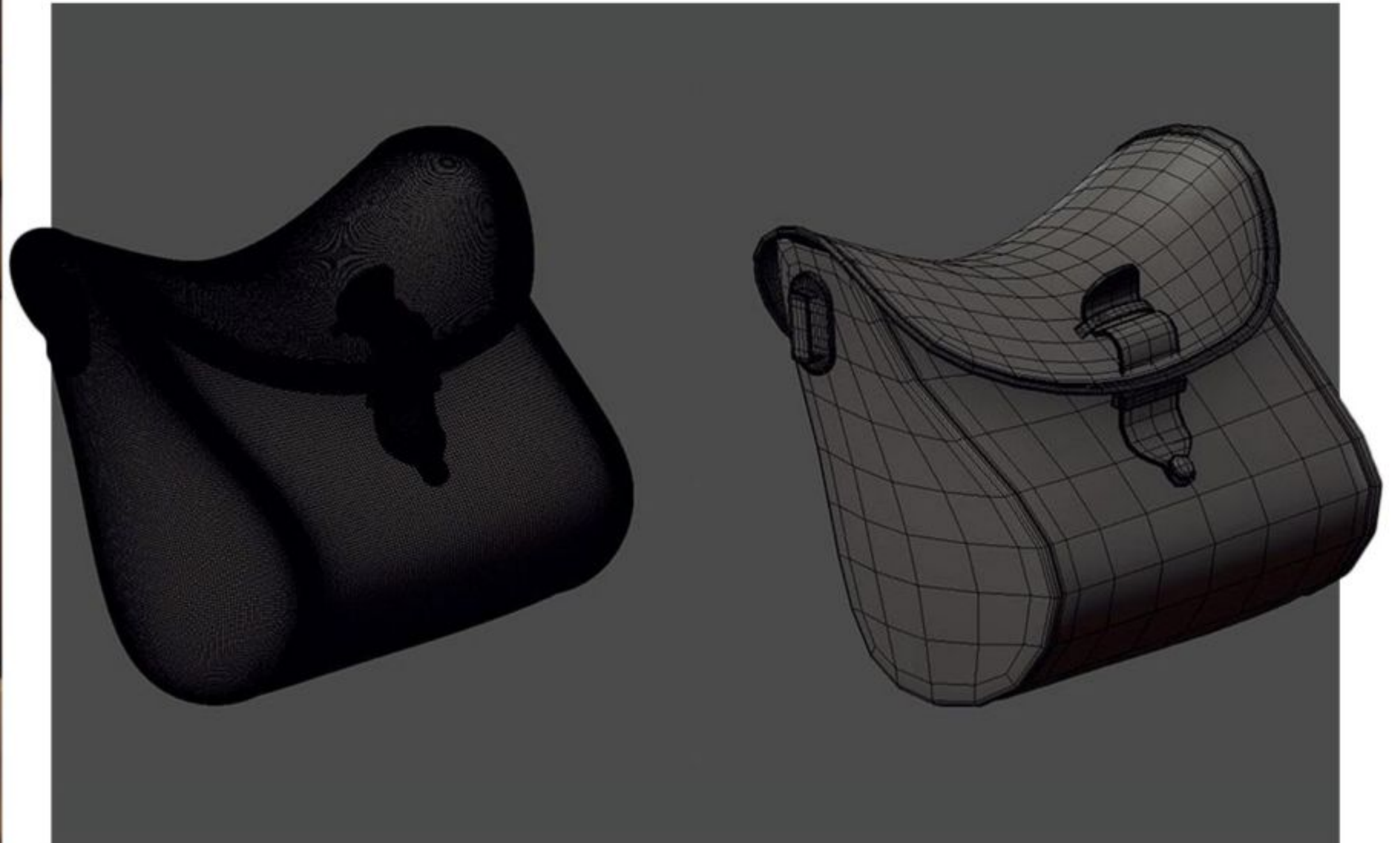
This is an important part for making organic shapes; a clean

TexTools

This is a free add-on for Blender 2.80 with a set of professional UV and texturing tools. It was released in 2009 with the original TexTools for 3ds Max, which has been very popular with many veteran real-time 3D artists.



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topology makes our work easier, uses less memory, and prepares the model to be animated. After sculpting the general shapes use the Grease Pencil tool and draw guides to make the topology easier to follow – with this the retopology will be more manageable. Finally, add the Multiresolution modifier and sculpt the last details. I used the Mesh: F2 add-on, which accelerated this stage quite a lot with the option to create Faces with the F key.

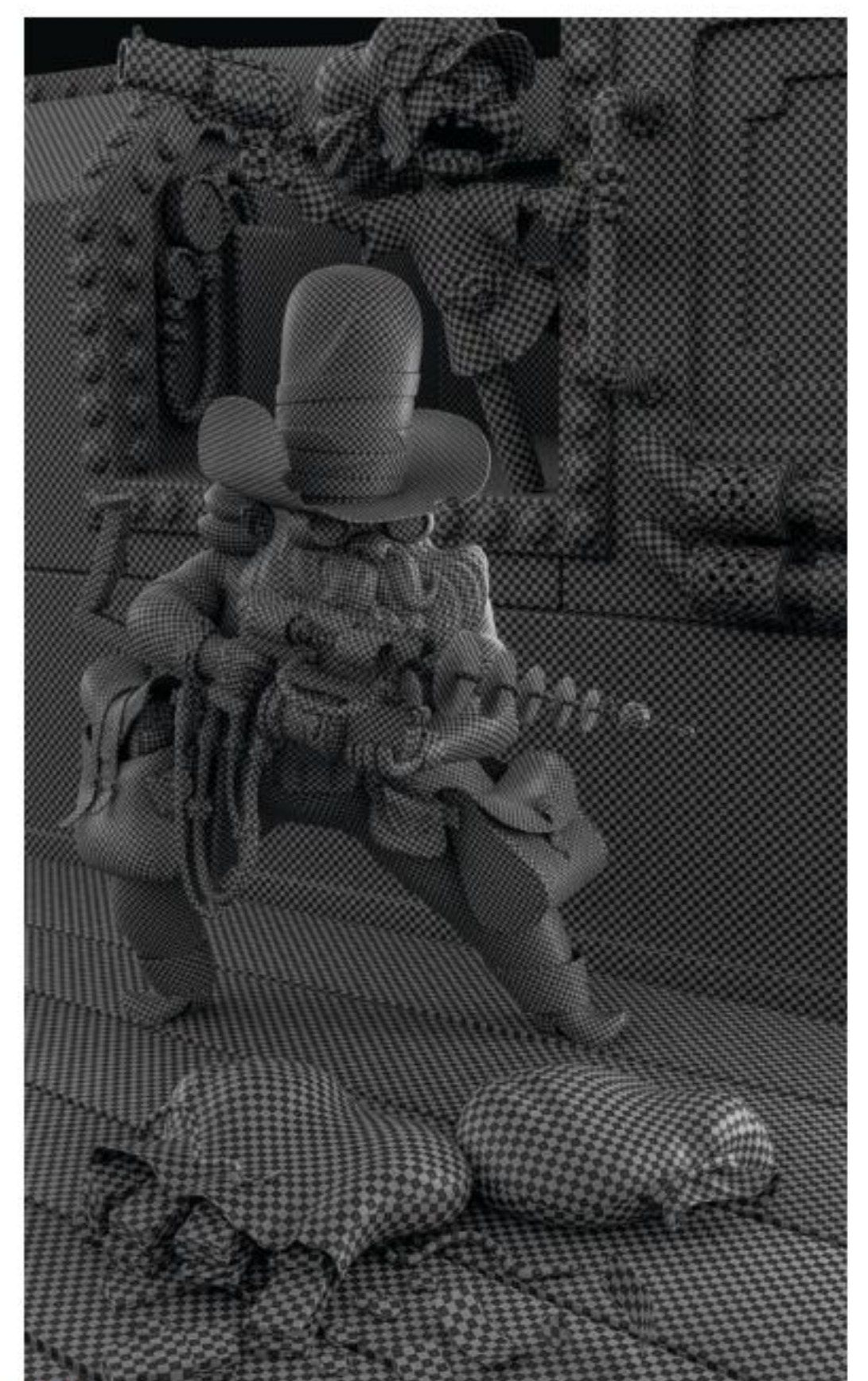
06 UNWRAPPING

To make a low-poly take a high-poly with the Multiresolution or Subdivision modifier with a high number of subdivisions, then make a copy downscaling to one subdivision or maybe two, then apply the modifier. Mark the seams of the low-poly with U>Mark Seams and hide them as best as possible. To unwrap, first select all faces in Edit Mode tapping A twice, and then unwrap with U>Unwrap.

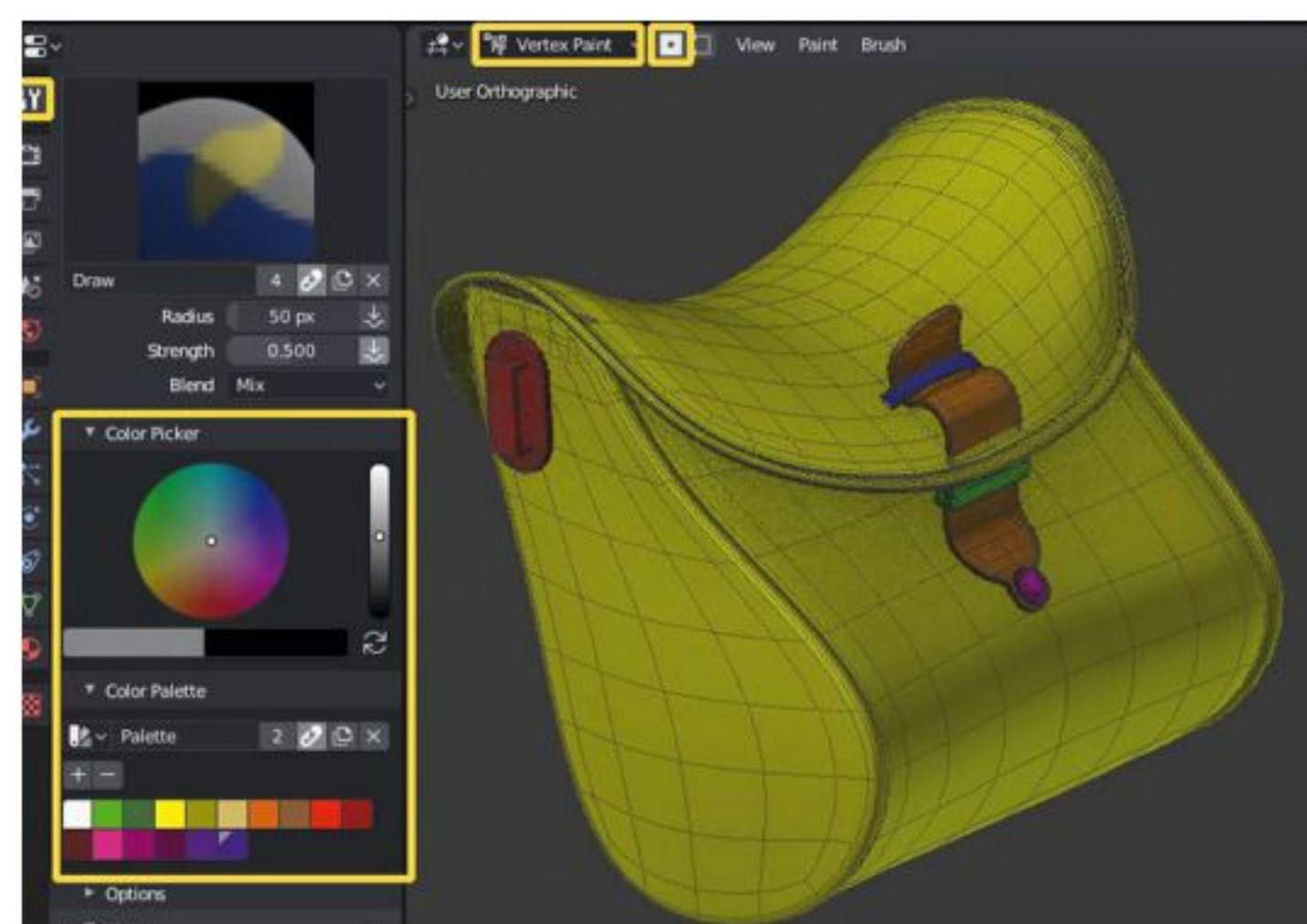
There are two methods, and I always try both to see which has the best result, Angle Based or Conformal. Pack everything with Pack Island. Finally, you can use the TexTools add-on to align and make some islands straight in the UV/ Image Editor.

07 TEXEL DENSITY

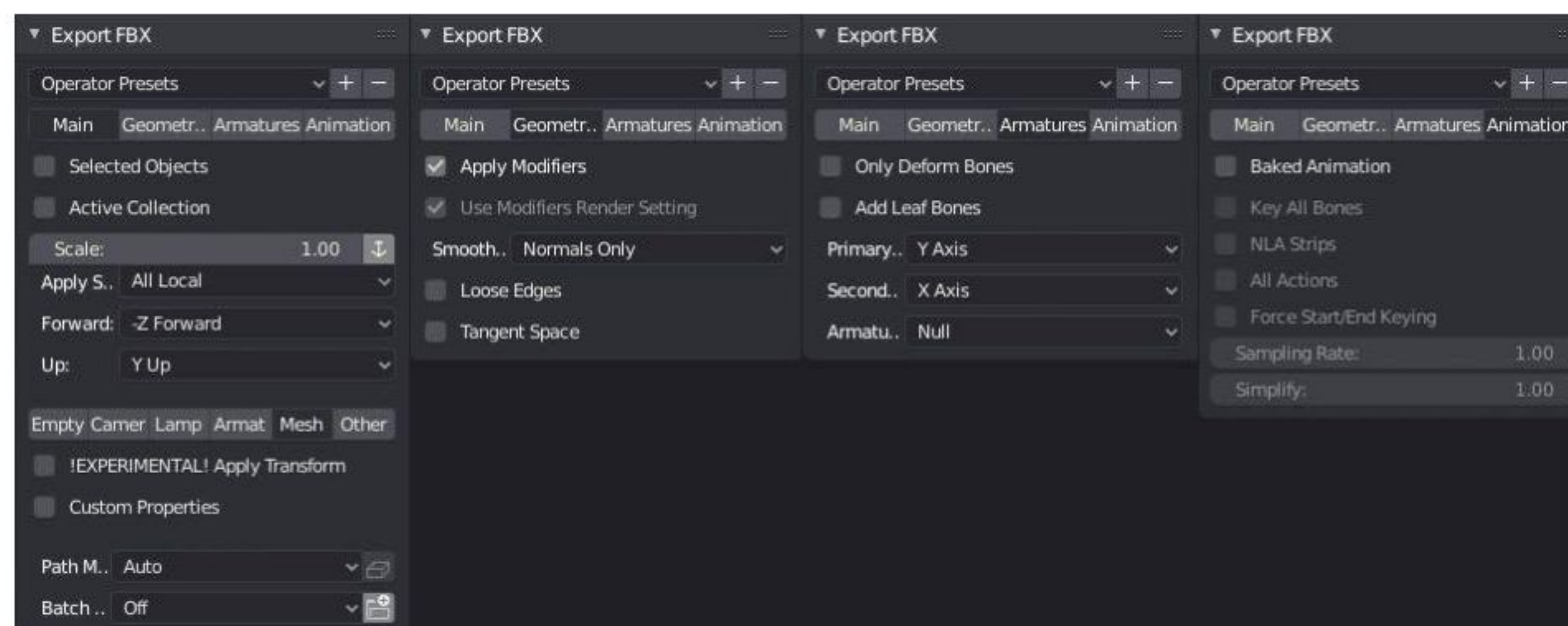
The resolution of the texture is measured in texel density; the goal is for all objects to have the same texel density, but sometimes this is not possible. In this project, I divided the texel density into two categories, one with the general objects with a texel density of 2,048 px/mts and the main with the cowboy that has double (4,096 px/mts) to be able to make close-up shots. For this I used the Texel Density Checker add-on.



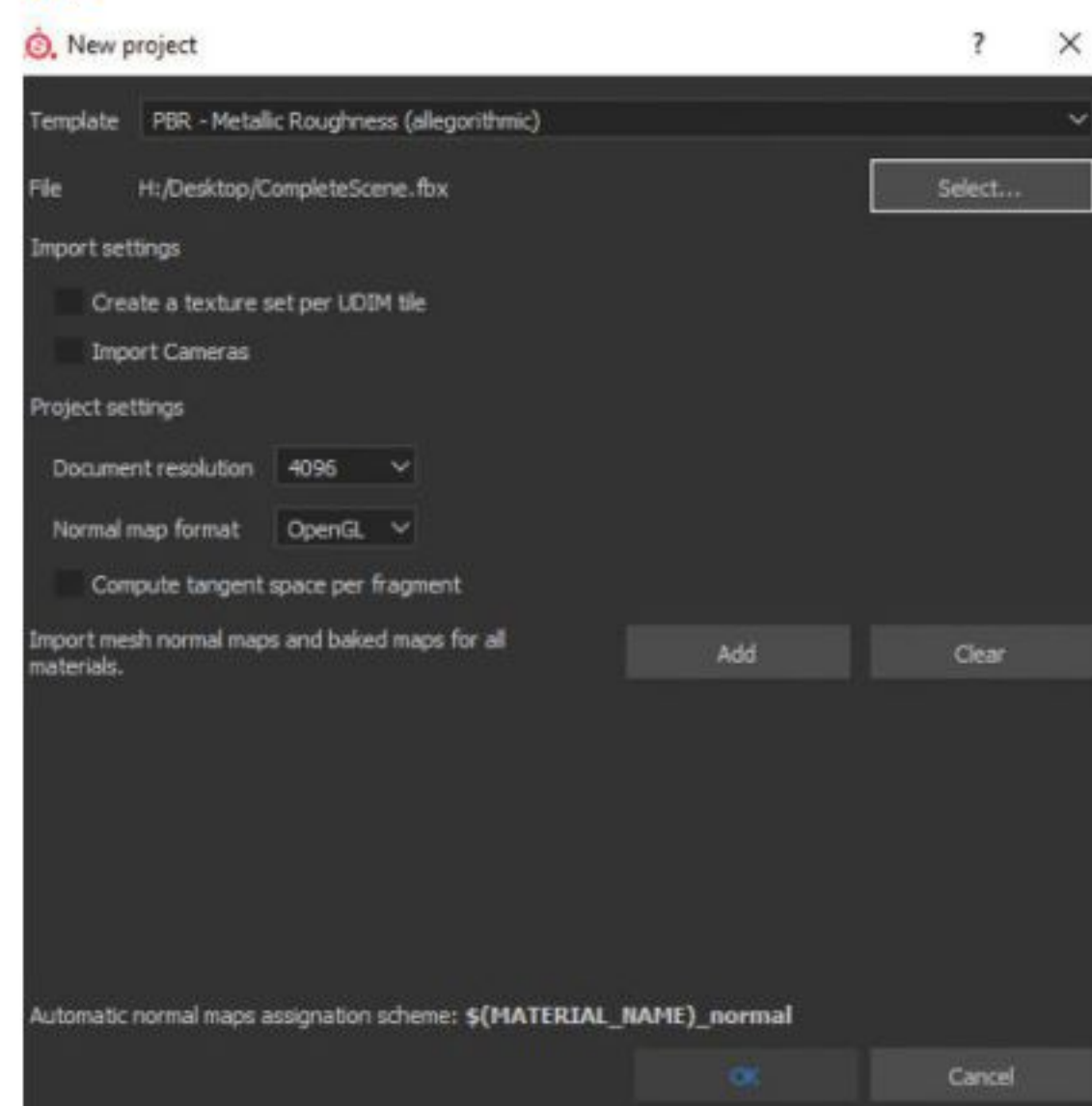
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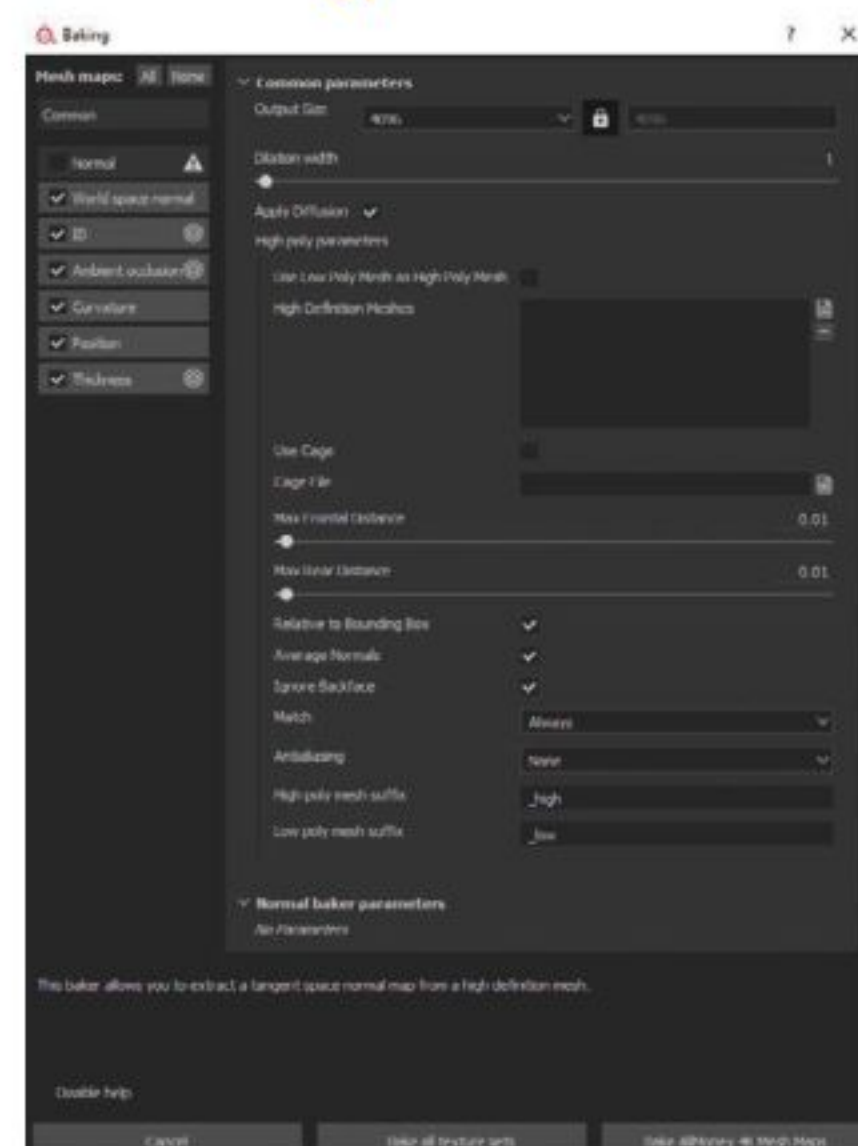
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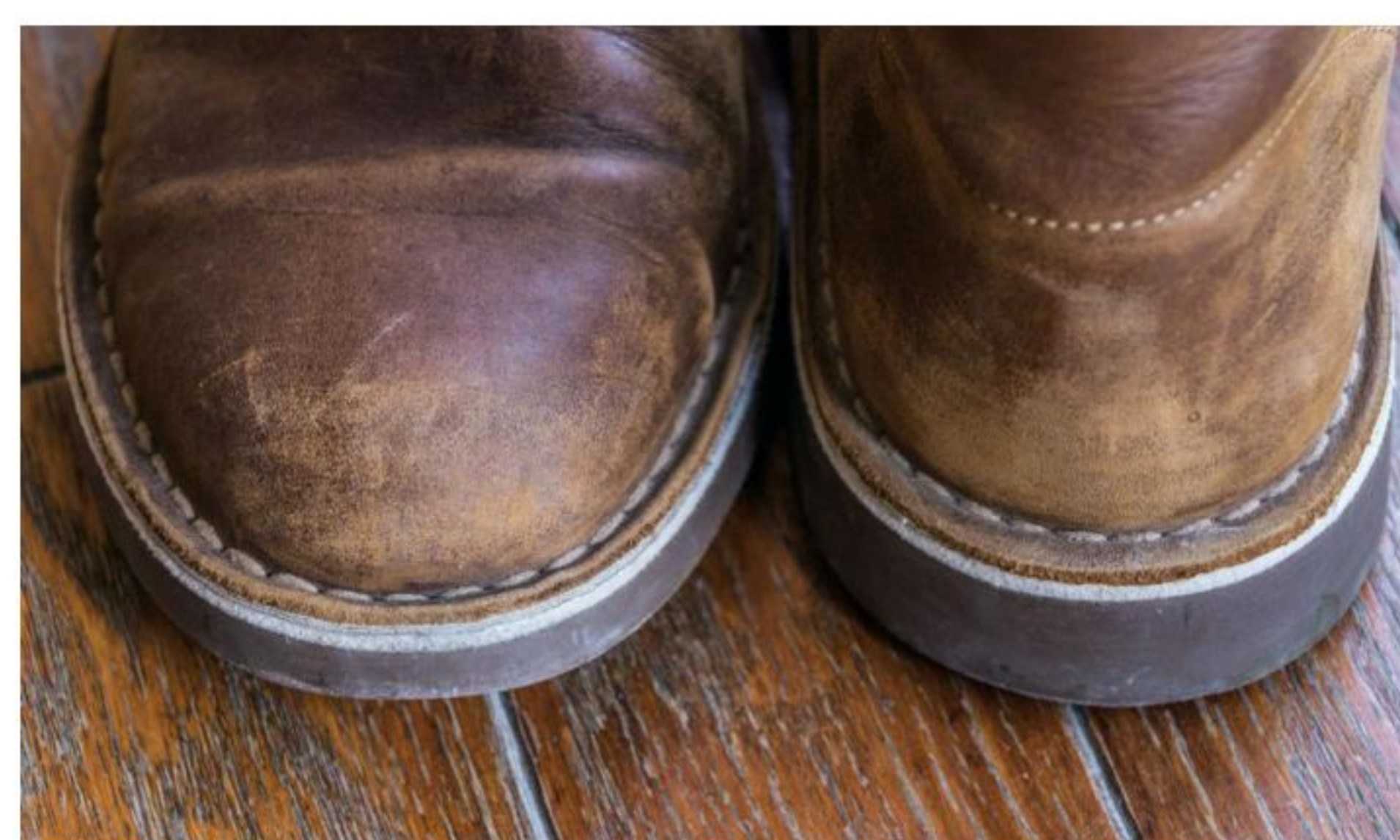
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08 COLOR IDS

Having Color ID facilitates the selection of mesh areas in Substance Painter. To make them inside Blender, go to Vertex Paint Mode, create a series of colours then choose Face Selection and select the faces that will use the same material. Finally press Shift+K in order to apply the desired colour to the selection.

09 EXPORT TO SUBSTANCE PAINTER

To paint the model in Substance Painter we have to export it correctly. Inside Blender, select the complete low-poly version of the scene, and export it as FBX. Then export separately each high-poly also in FBX. It is necessary to activate Selected Objects when exporting a single object. The high-polys will serve to bake normal map details to the low-poly within Substance Painter.

10 IMPORT SETTINGS INSIDE SUBSTANCE

To import the mesh from Blender select the PBR – Metallic Roughness (Allegorithmic) template, and choose the low-poly scene in FBX. It is very important to select OpenGL in the Normal map

format – if you select DirectX your Normal maps will be backwards in your final render, and this needs to be avoided. For the resolution of the document try to use the resolution you will use for your final renders, in this case, all the Tilesets are 4,096.

11 BAKING

To work with smart materials accurately inside Substance Painter it is necessary to bake multiple maps. Select a big Output Size, at least the full resolution, which in this case is 4,096. Select all the maps except the Normal map and bake. If you have a high-poly mesh that you want to pass detail to a low-poly, bake again, but uncheck all maps except the Normal map and add the high-poly mesh in the high-definition meshes.

12 PHOTO REFERENCE FOR TEXTURING

There is no better way to make a texture than having a clear idea of what you are looking to achieve. The quality of details you can reach in the texture increases relative to the number and quality of the photo references. Make a collage for each object, focusing on weathering and scratches, how the material reflects,

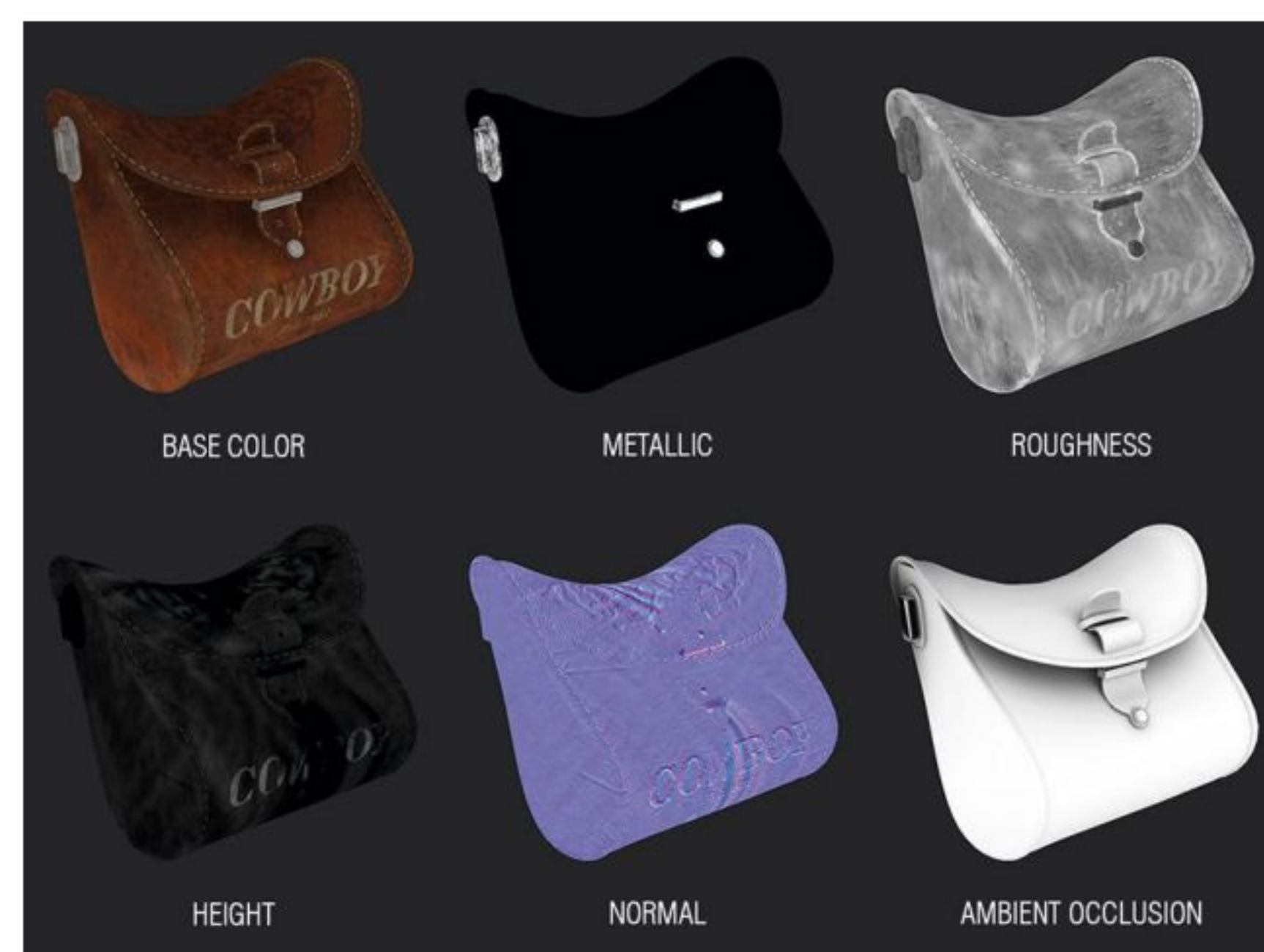
Tilesets

It is necessary to have a unique material for each Tileset, otherwise you will see some texture painting overlap inside Substance Painter.

and colours. This may sound like a lot of work, but with this, you will have better results than if you don't have any reference material at all.

13 PHYSICALLY BASED RENDERING

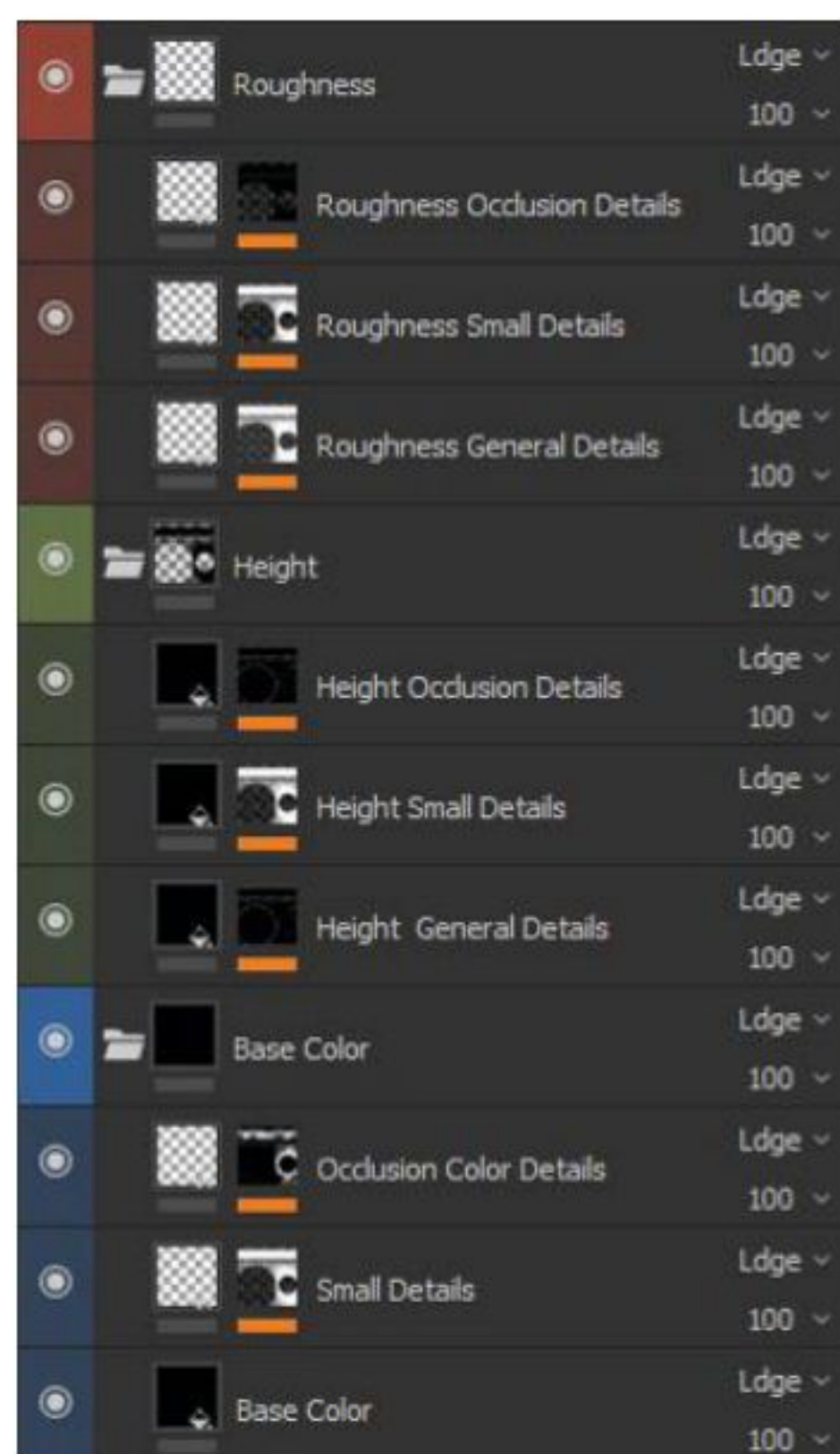
Understanding the theory of PBRs is the base for creating better textures. PBR is a physically correct method for texturing and rendering, and it is easier to achieve more realism than the previous Specular/Glossiness method. Within Substance Painter I used the Metal/Roughness workflow where different types of maps are used: Base Color, Metallic, Roughness, Height, >



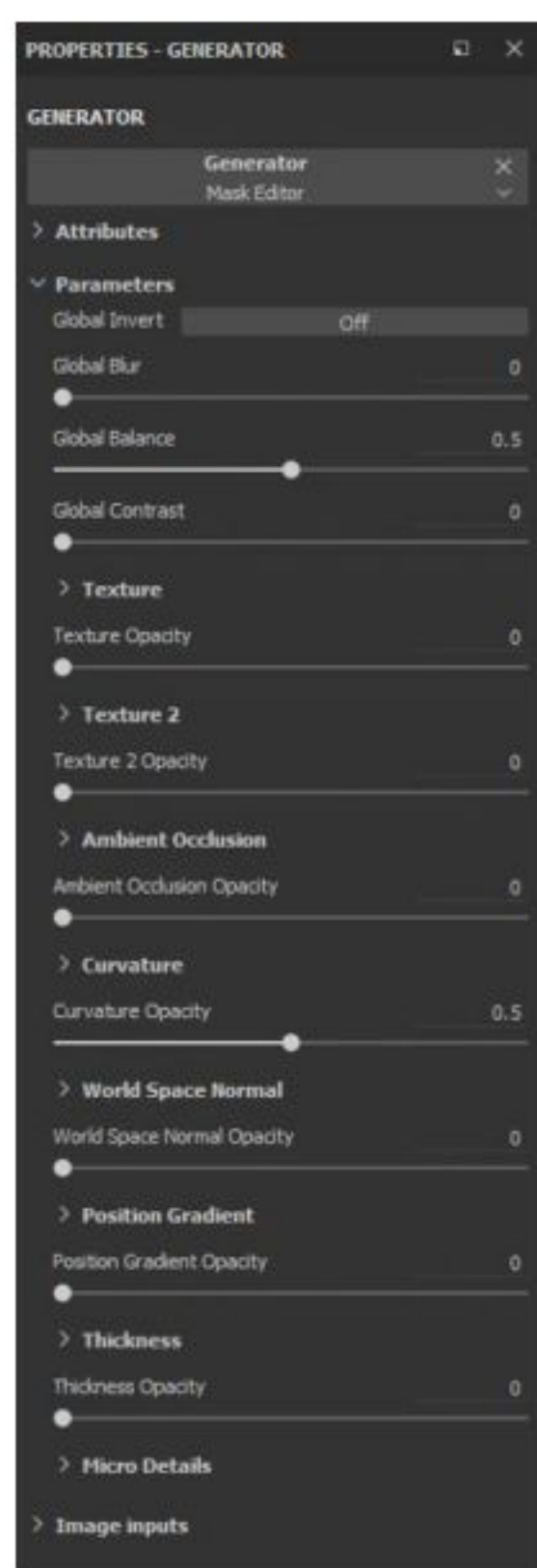
13

TUTORIALS

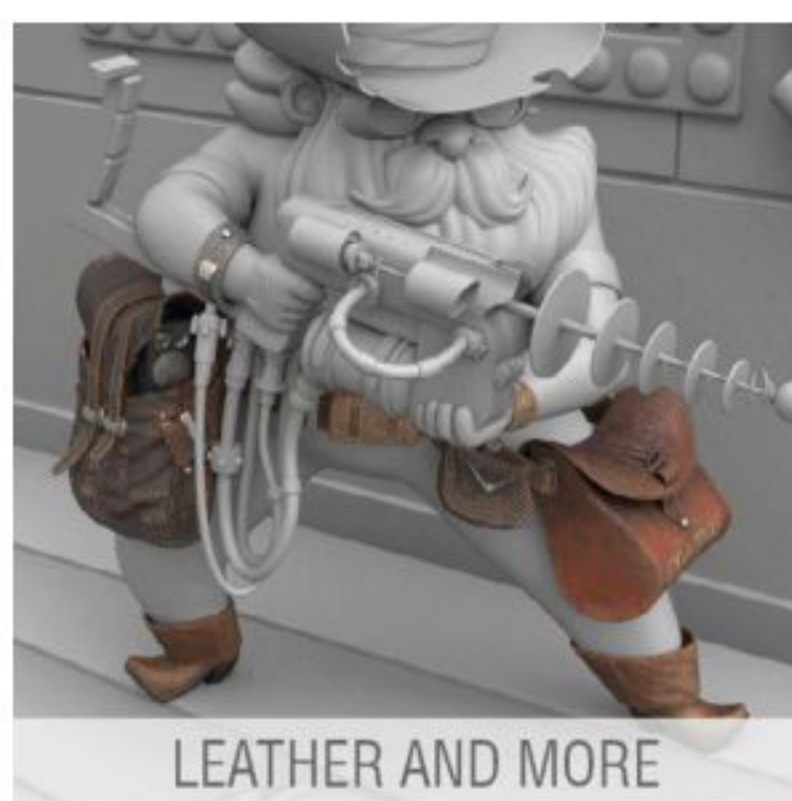
Design a 3D scene with Blender & Substance Painter



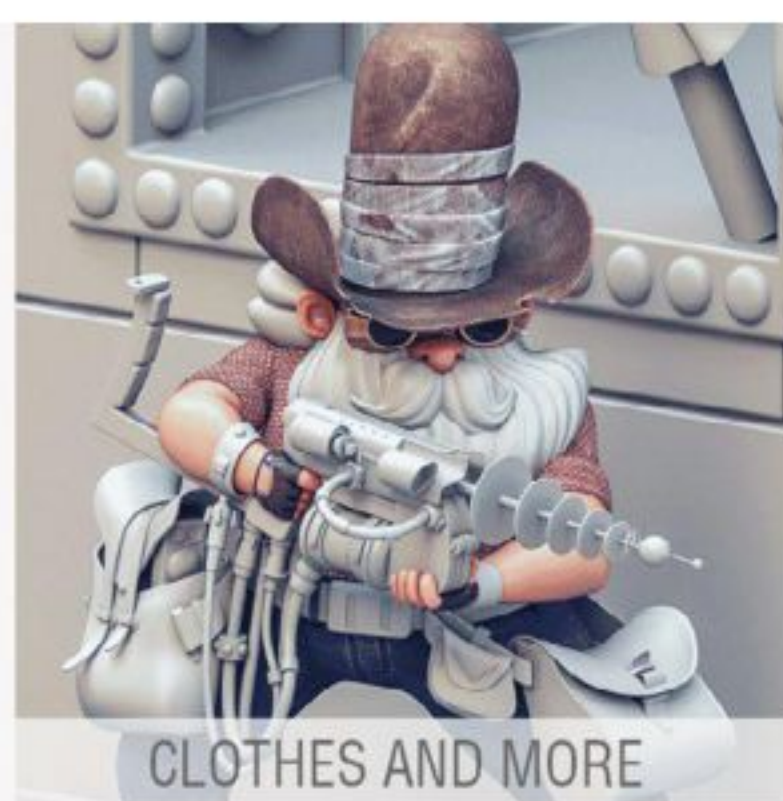
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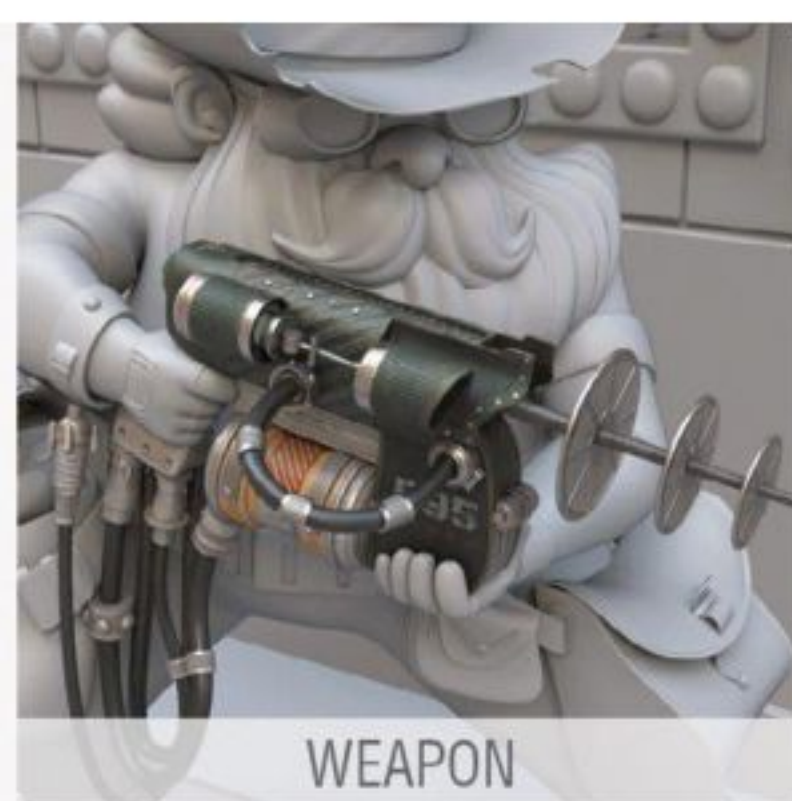
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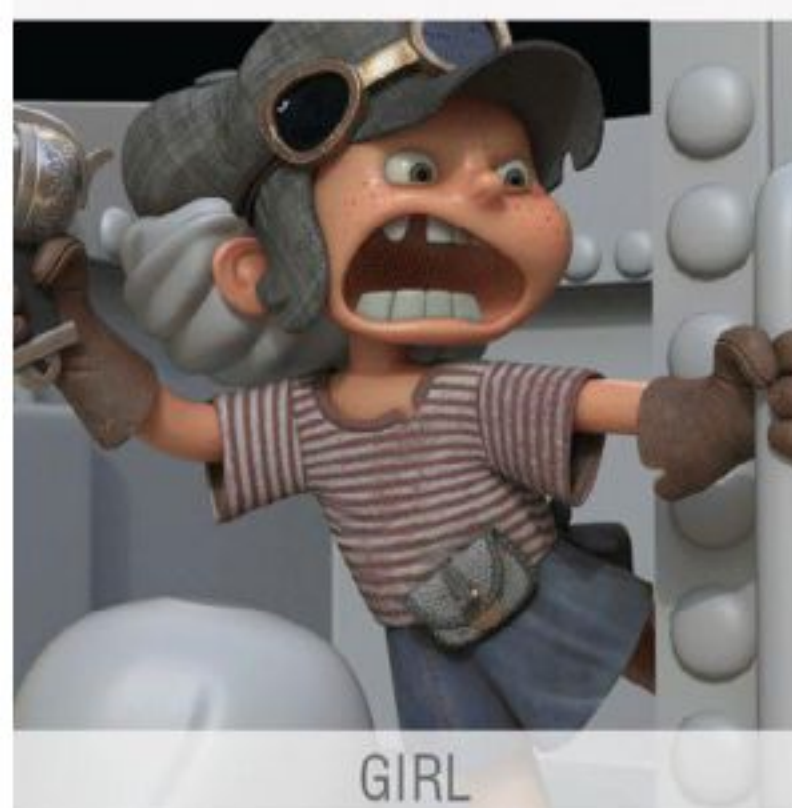
LEATHER AND MORE



CLOTHES AND MORE



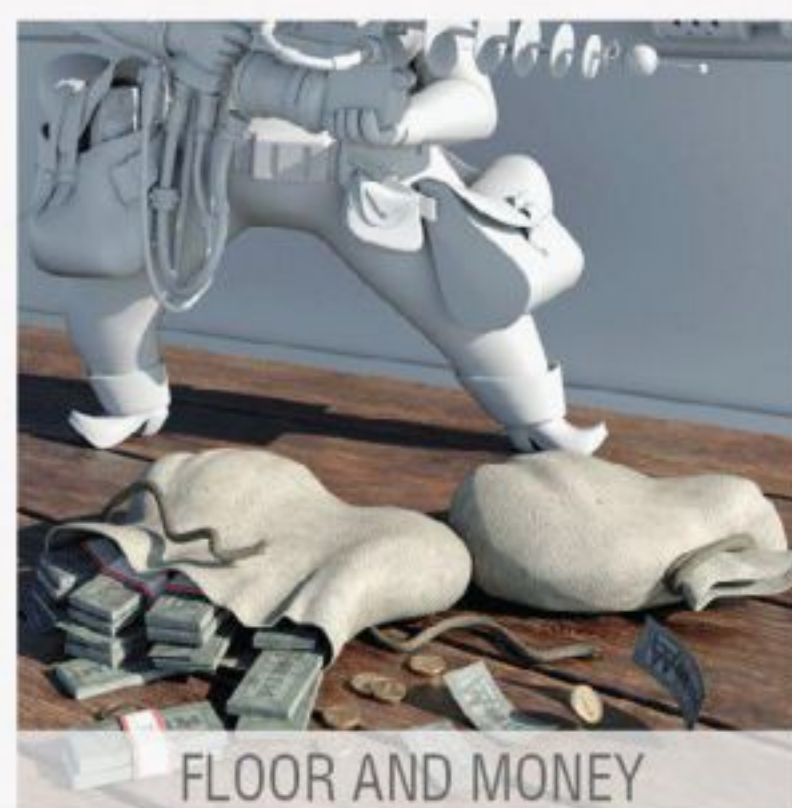
WEAPON



GIRL



TRAIN



FLOOR AND MONEY

16

➤ Ambient Occlusion, Normal, Emissive and Scattering.

14 CREATE BASIC MATERIAL

The base structure of the simplest material consists of only three maps: Base Color, Roughness and Height – these are the foundation of the most basic materials. With this fundamental combination, you can create all kind of non-metallic materials, like cloth, leather, plastic and much more. I use three levels of details for each type of map and group them into folders: General Details for weathering, Small Details for scratches, and Occlusion Details for colour changes.

15 MASKING

The Generator is used to design the masks that affect the materials. There are several parameters within the Generator>Mask Editor, and each parameter has different effects; the most used are Texture, Ambient Occlusion and Curvature. The mask can be as complex as you want it to be, it is only necessary to stack effects one over another. Use multiple generators and different Blending Modes to achieve the mask you have in mind.

16 PAINT THE SCENE

When it is a medium or big scene, painting everything with the highest resolution generates problems like a lot of lag, or file errors due to lack of memory. To

solve this I used the same FBX file as a base and made separate SPP files of Substance Painter for each area. For this project, I divided the scene into six files of Substance Painter, one file with the cowboy leather stuff, the cowboy clothes, the plasma rifle, the girl, the train and the floor + money.

17 EXPORT MAPS FOR BLENDER

Make an export preset with eight output maps for Blender, because there is no pre-made preset inside Substance Painter. Go to Export Textures>Configuration and create a new preset with New Export Texture. Create a Base Color with RGB, Metalness with Gray, Roughness with Gray, Normal OpenGL with RGB, Ambient Occlusion with Gray, Emissive with RGB, Opacity with Gray and lastly Scattering with Gray. If your scene does not have a map of this list, it will be discarded from the export.

18 USE PRINCIPLED BSDF

Save time by adding all the output maps at the same time, with the Node Wrangler add-on activated. This add-on is a suite of tools to help make node editing in Blender easier and quicker. Node Wrangler is included in Blender by default, so you just need to turn it on. Use the Control+Shift+T shortcut and load the basic PBR maps. Select the Base Color, Metalness, Roughness and Normal maps, they connect automatically.

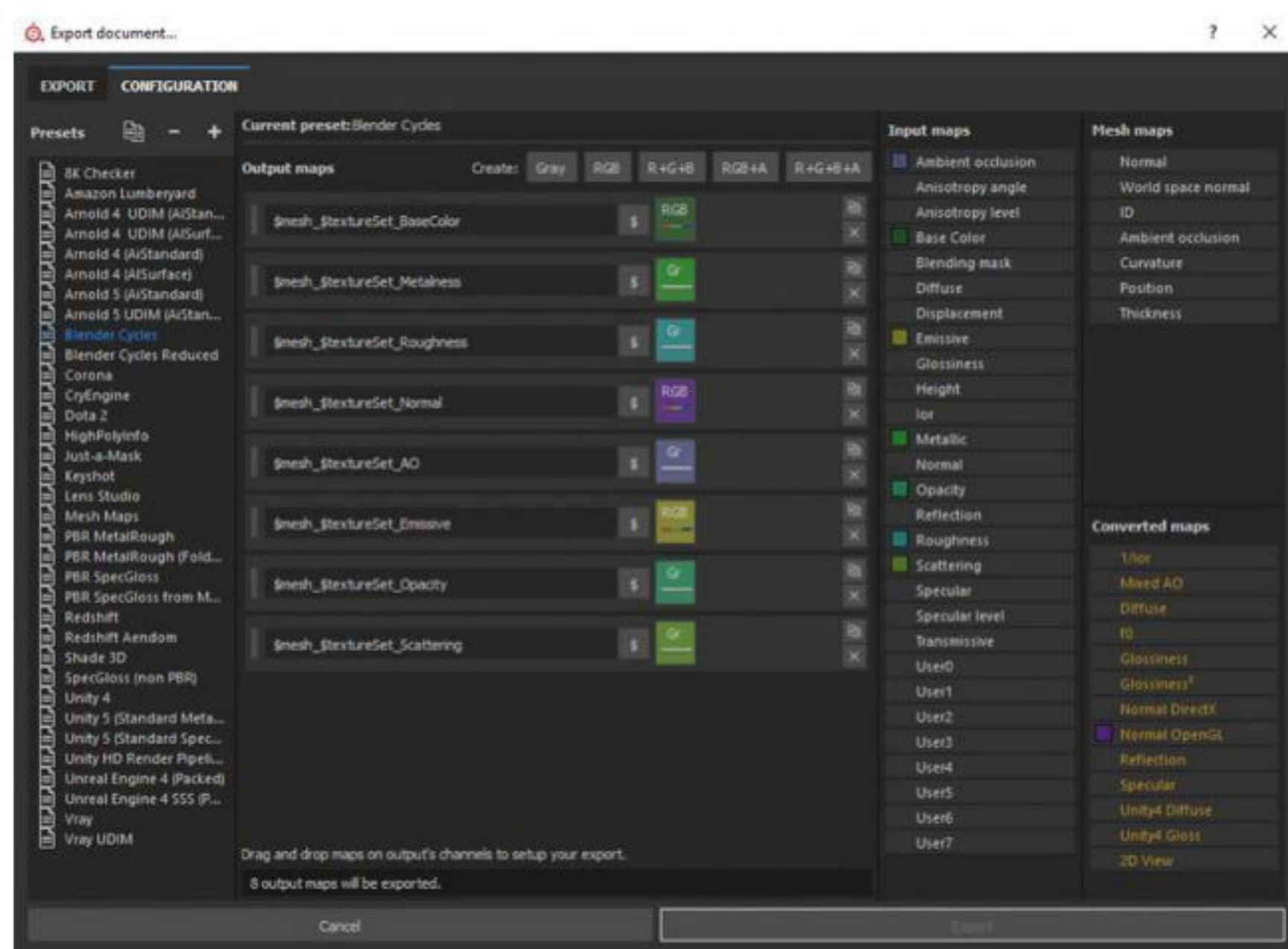
PBR Validate

The PBR Validate material given in Substance Share helps to find errors in the Base Color and Metal values of your PBR material, making sure they are within adequate ranges.

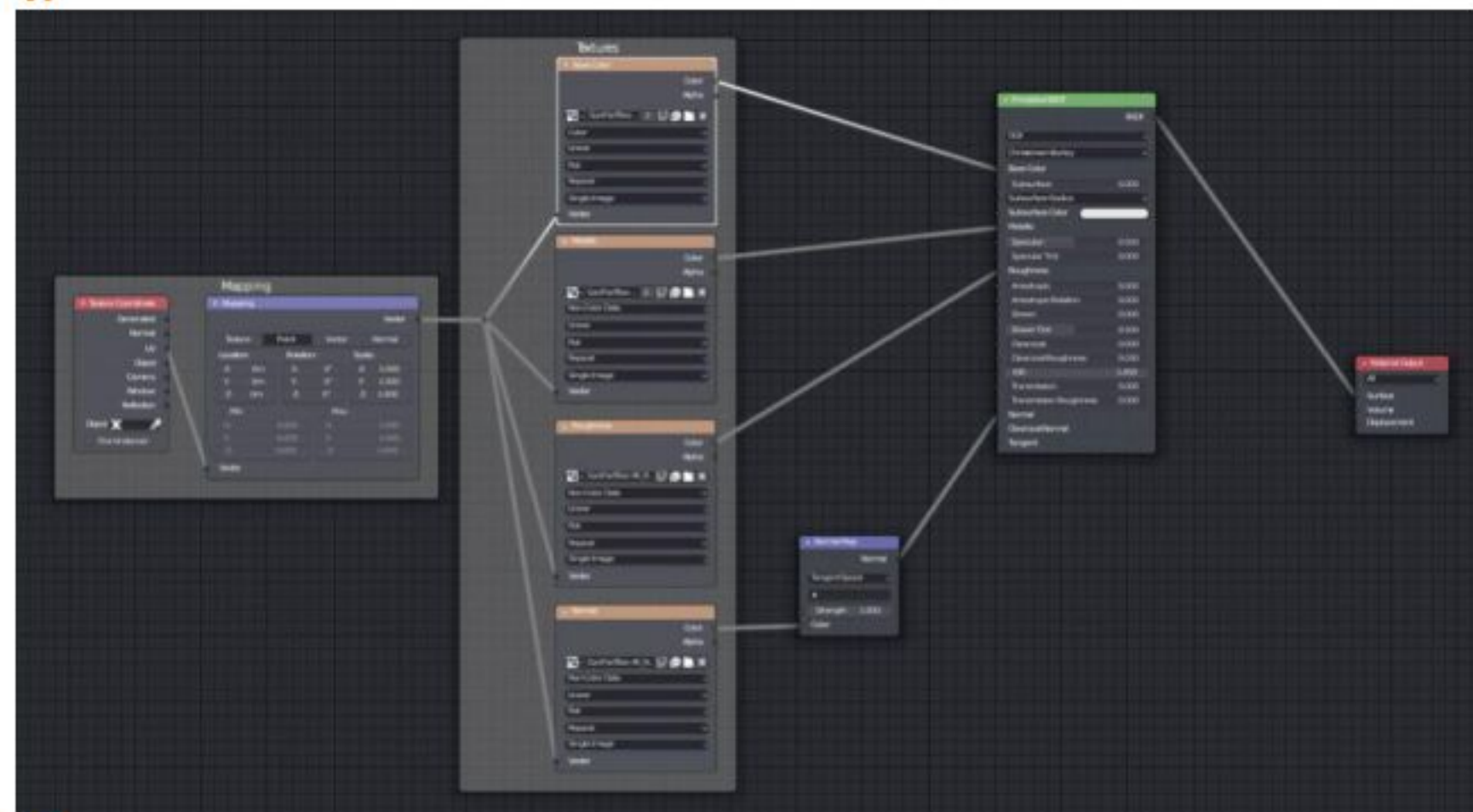
Manually you have to add maps such as Ambient Occlusion, Emissive or Scattering.

19 UTILISE THE HAIR PARTICLES SYSTEM

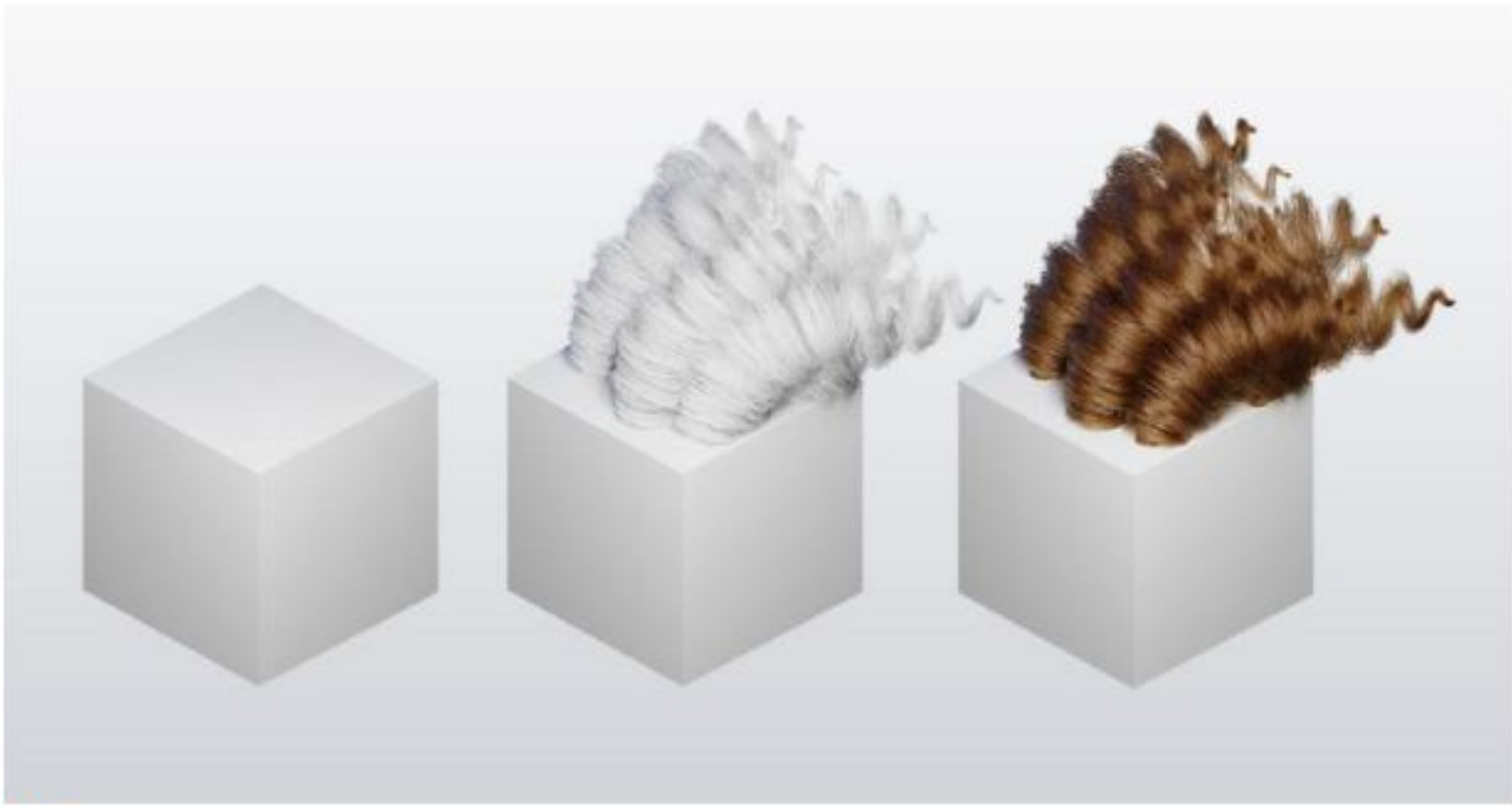
To generate hair we need three things: an emitter where the hair comes out, the particle system where we decide how it behaves and finally, the material that defines how it looks. For this workflow we first chose the emitter and added a Hair Material, then add a Hair



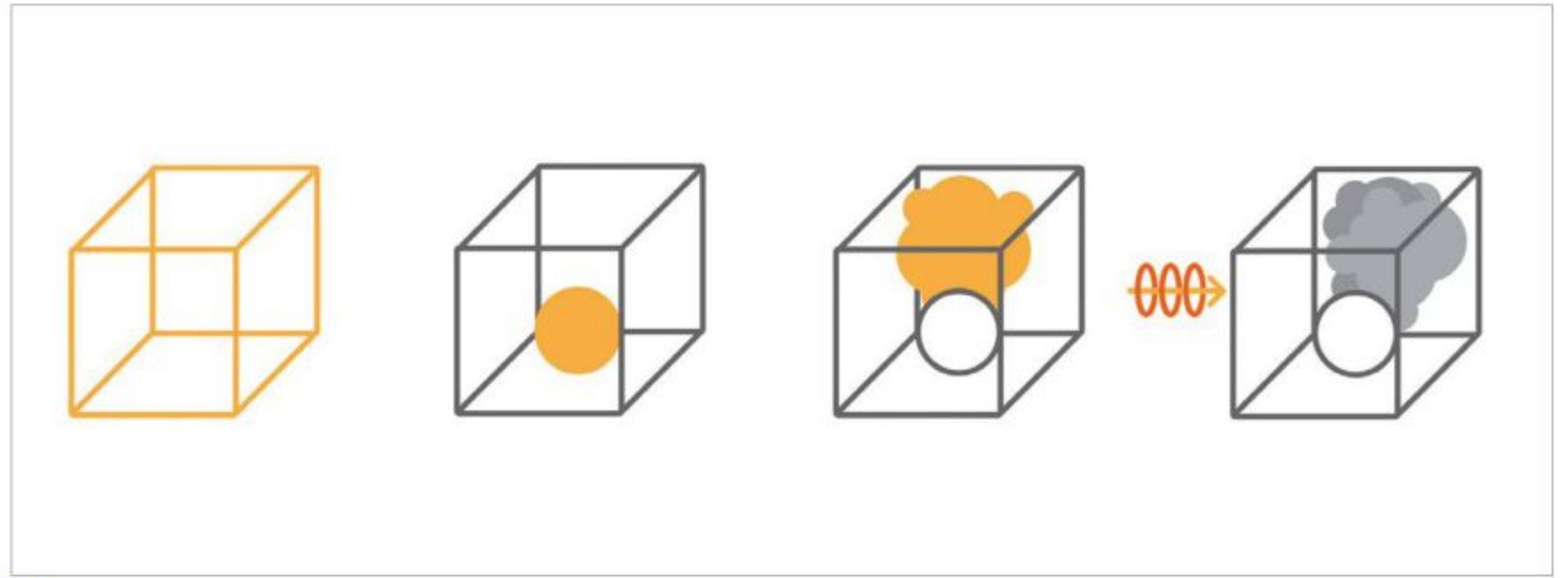
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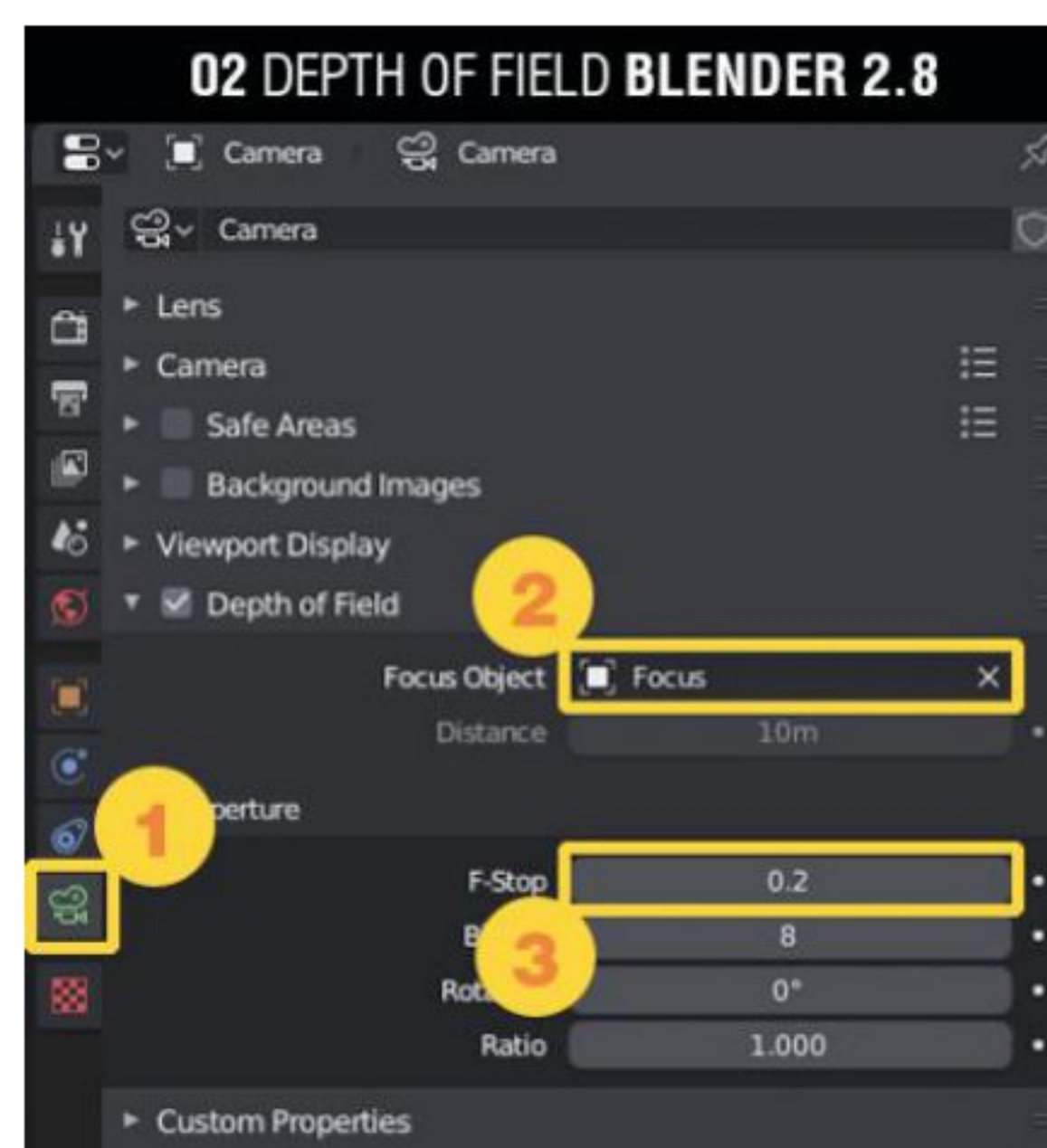
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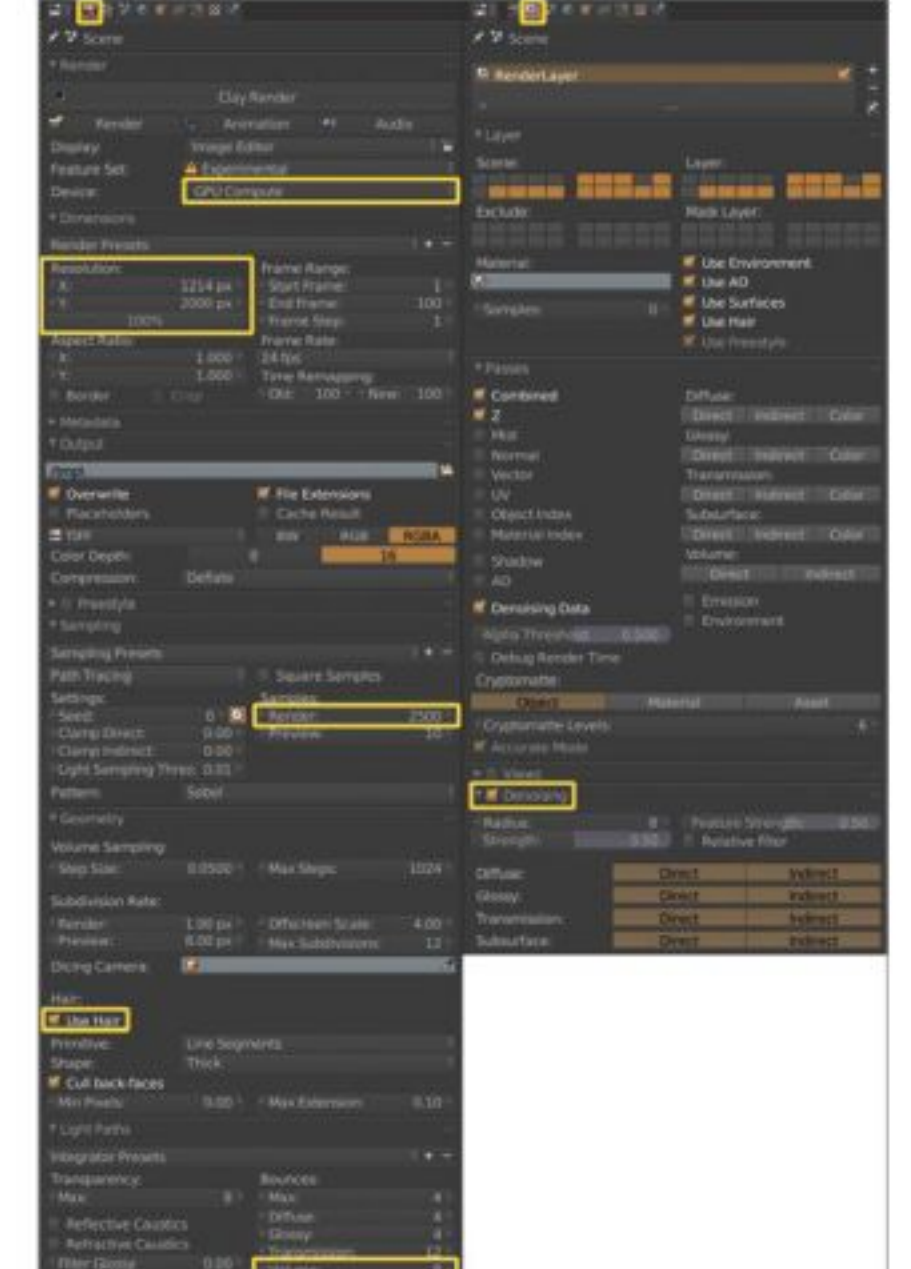
20

	MASTER LIGHTS		SHOT LIGHTS		
	FILL LIGHT	KEY LIGHT	RIM LIGHT	KICK LIGHT	BOUNCE LIGHT
LIGHT	HDRI	SMALL AREA LIGHT	SMALL AREA LIGHT	BIG AREA LIGHT	BIG AREA LIGHT
SHADOW	DIFFUSE	SHARP	SHARP	DIFFUSE	DIFFUSE
TEMPERATURE	COOL	HOT	COOL OR HOT	COOL	COOL OR HOT
STRENGTH	1 - 5	50 - 100	1 - 10	1 - 5	1 - 5

21



22



23

Particle System, choosing the length and style of the hair. Finally, in the Particle Edit Mode, design each hair one by one. Use the Principled Volume BSDF for handling the colour of the hair.

20 SMOKE SIMULATION

Smoke simulation is part of the fluid system, which is animated in voxels representing the density, heat and velocity of the fluid. To do the simulation we need four elements. The Domain is where the area of the simulation is located, and the smoke cannot leave this area. The Flow is the mesh where smoke, fire or both are produced. The material using the Principled Volume BSDF material is the PBR material for making smoke. And lastly, Wind that generates a constant force in only one direction.

21 LIGHTING BASICS

The goal of lighting is to explain the depth, shape and emotions in the best possible way. We can achieve this with five types of lights: Key Light, Fill Light, Rim Light, Kick Light and Bounce Light. The Key Light and Fill Light are the most important and fall into the category of Master Lights, the others fall into the category of Shot

Lights. Also, we must bear in mind that when we talk about colour we have to think about temperature, whether warm or cold.

22 DEPTH OF FIELD

With this camera effect, I emphasised the main character over the rest of the scene. To use depth of field in Blender, it is necessary to have a camera and an empty object – this last one is used to focus. Use F-stop to decide if you want a deep or shallow depth of field. I did several tests on it before deciding which one I would use for the final render.

23 GLOBAL CONFIGURATION BEFORE RENDERING

Before doing the final render, it is necessary to check that the configuration is optimal for the scene. Make sure that the resolution is correct and to 100%. Input the minimum necessary Samples, select Use Hair if relevant, and if you are simulating smoke it is necessary to have a number in the Volume section. Finally, check Denoising to remove the noise.

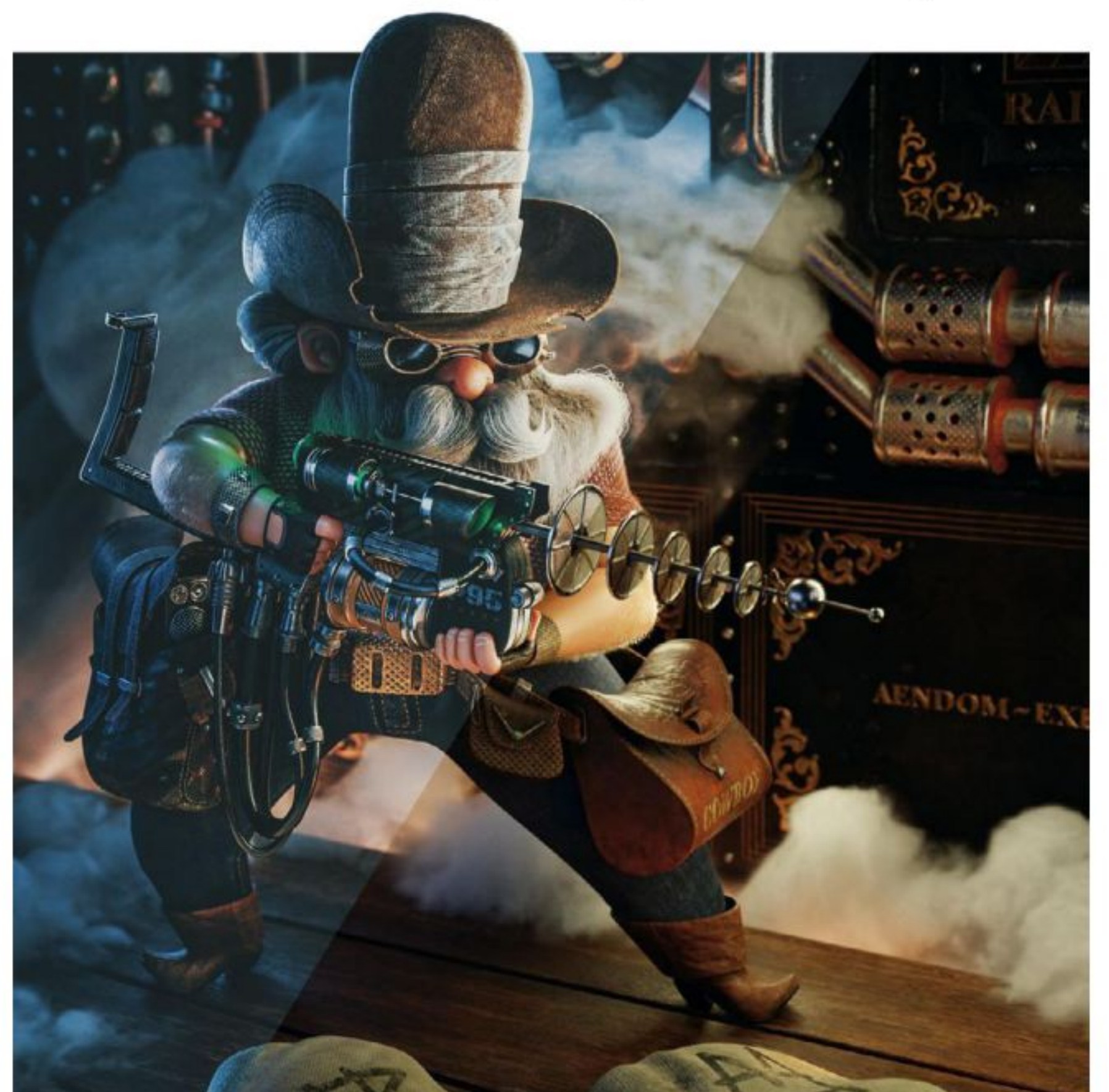
24 POST-PRODUCTION

In this stage, I highlight the details with different methods

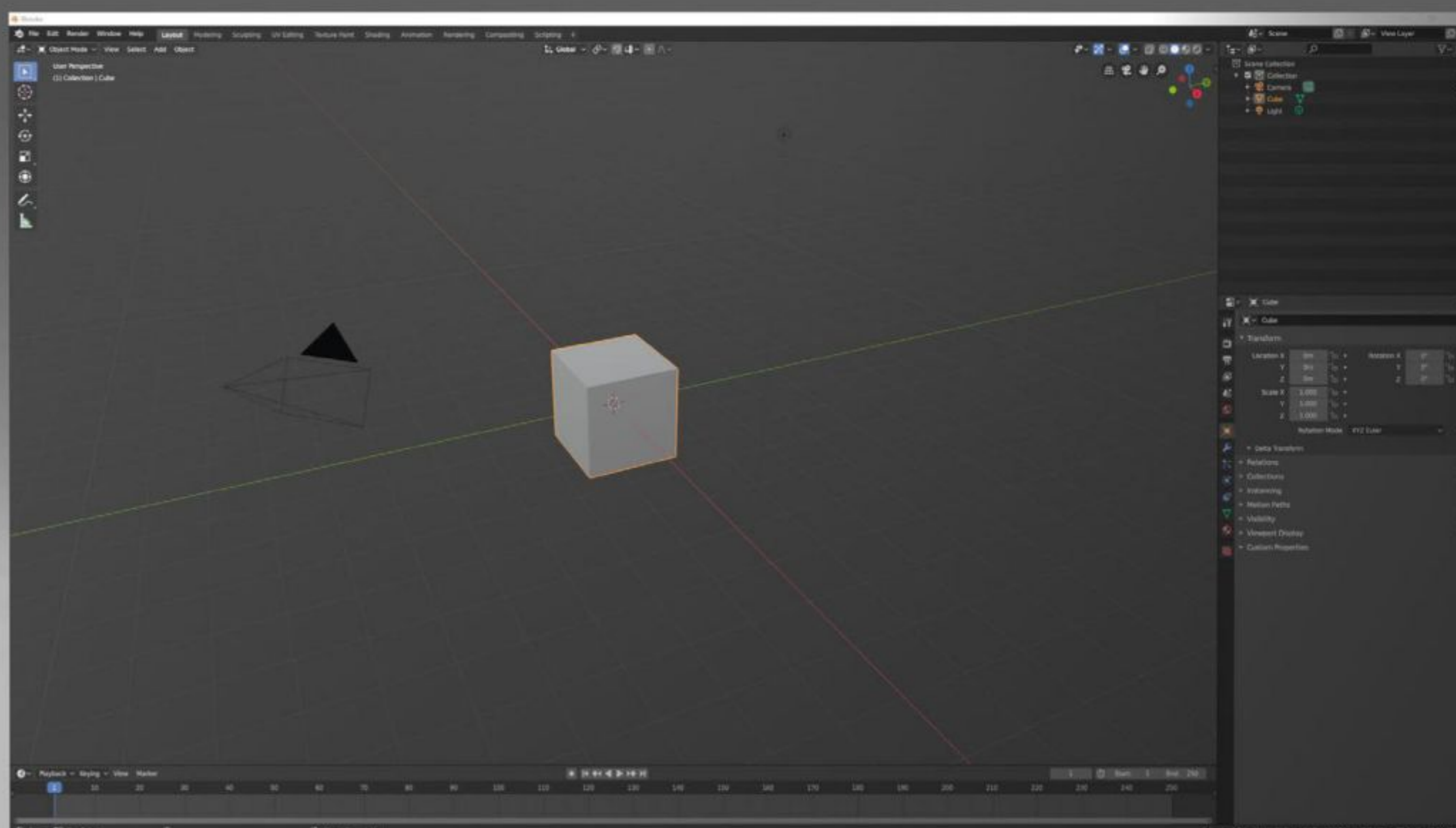
HDRIs

In this project I used an HDRI that Pixar shared from the short *Piper*. To use them change the filename extension from TEX to EXR. There are other options like HDRI Haven if you need resources.

and decide the general colours to generate an atmosphere inside Photoshop. I divide the post-production into three methods. I colour correct with Camera RAW, seeking to balance the colours, modifying the lights, shadows and sharpness of the image. I colour grade using LUTs, improving the visual tone of the image for aesthetic and narrative purposes. Lastly, I use vignetting, gradients and masks to focus on the most important parts of the image. •



24



3D BASICS

BLENDER BASICS

For the next instalment of our Basics series, we take a look at the core digital content creation applications, starting with Blender

If you are new to CGI, there are far too many tools to choose from in a dizzying array of software. This series aims to break everything in CGI down to the very basics so that every artist is armed with the knowledge of which tool is best. This month we look at Blender.

Blender for years has been one of the great paradoxes of the 3D creation toolset. It is completely free and has one of the most diverse feature sets of any digital content creation application, and with cutting-edge render options... why would anyone use any other application?

The reason was that Blender historically has liked to plough its path in the mechanics of how 3D is created. Blender is developed as an open-source application

by developers from around the world. While this, on one hand, is great as it allows the previously mentioned diverse toolset. This way of developing did also lead to an application that, while as stable as many other applications on the market, lacked the refinement in terms of the user experience. This would mean that many 3D artists who came over to Blender would find that its 'unique' way of working would get in the way of the vast array of creative possibilities that Blender is capable of.

The core team behind Blender though have grasped this issue with the latest major release, version 2.8. With Blender 2.8, the user interface gets a very professional lick of paint and is infinitely friendlier for a new

artist coming to Blender. With tooltips along the bottom of the screen, logical toolbars and dialog boxes and *finally* the left-mouse button now set as default, Blender 2.8 is friendlier than it has ever been – and because of this new friendliness, Blender gives artists the opportunity to really see what the software is capable of, and the answer is, practically anything that an artist would want.

Modelling, animation, FX, sculpting, rendering and compositing are all available within Blender, which can be rendered with a variety of GPU-accelerated, real-time and NPR-style render options. With version 2.8, the argument for not using Blender in a 3D pipeline becomes moot, as it is now the best bargain available for 3D artists.



AUTHOR

Mike Griggs

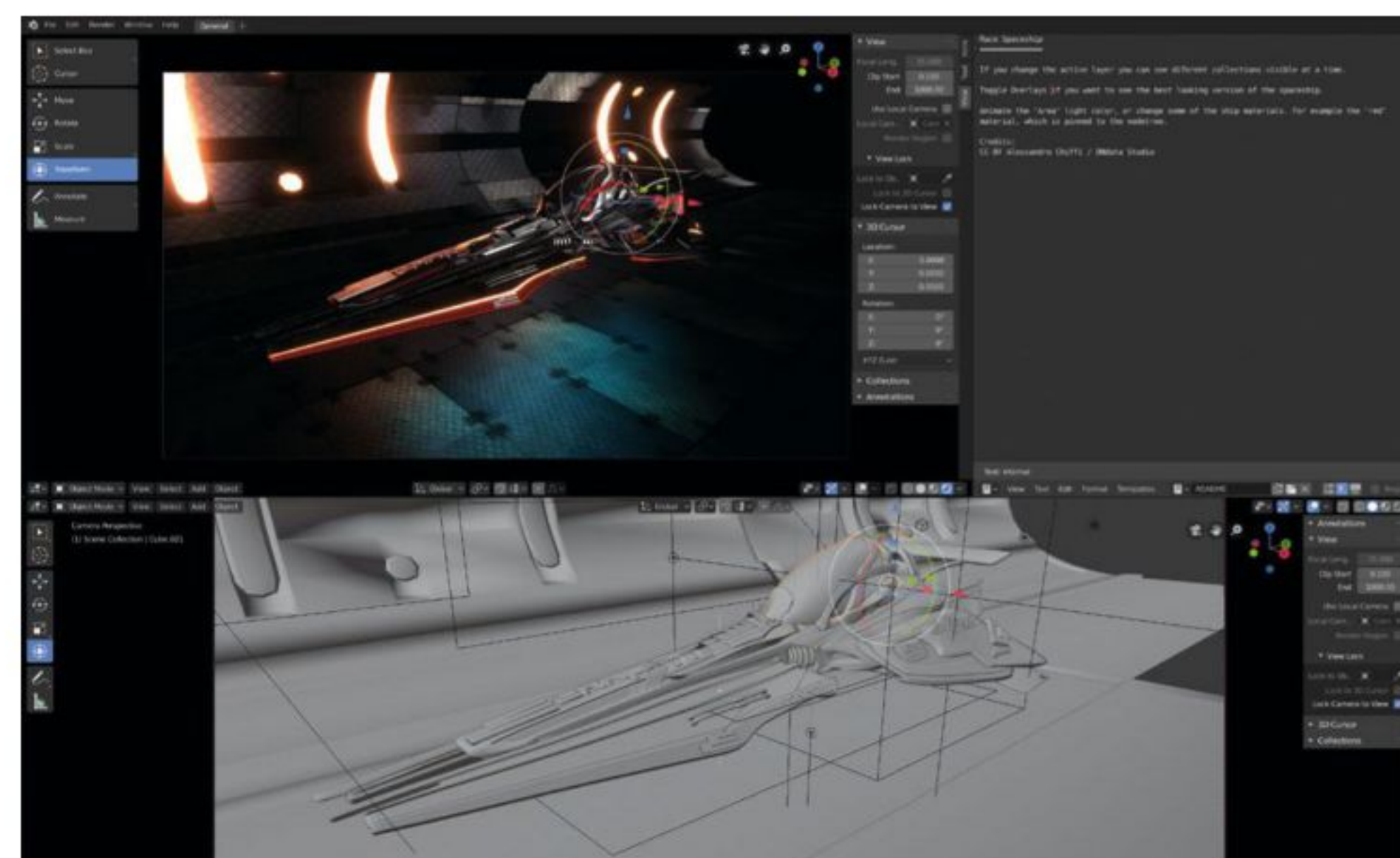
Mike Griggs is a 3D and visual effects artist with vast experience across the industry, as both a creator and a technical writer.

www.creativebloke.com



01 THE NEW UI

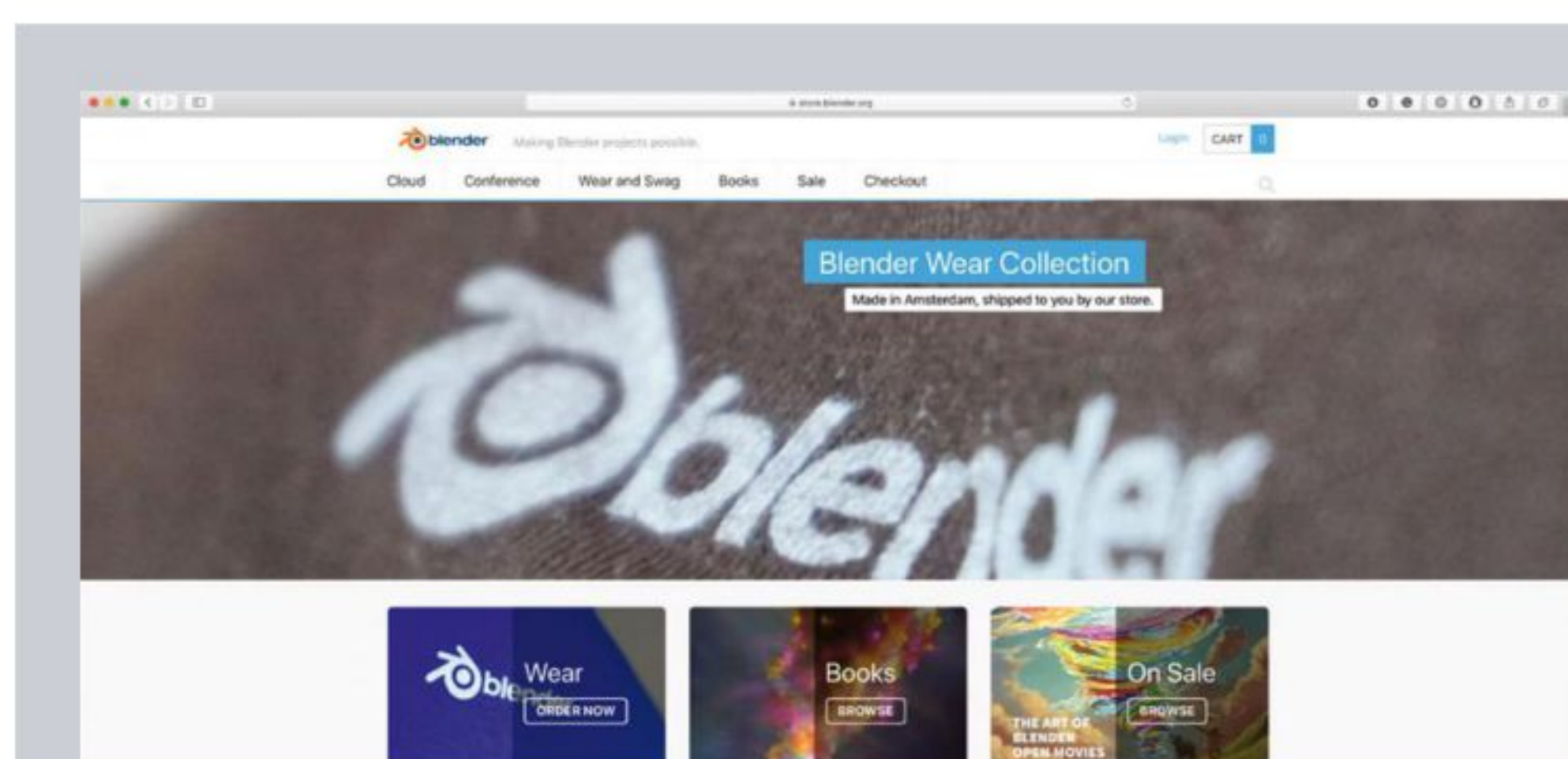
Blender 2.8 fixes many of the issues for artists who are embedded with other 3D software and find it challenging to integrate Blender into their workflows. First of all, like in most other 3D applications, the left-mouse button is now the default selection button, whereas in older versions of Blender it was the right-click button. Alongside a new refined dark look, with a logical tabbed interface across the top, Blender 2.8 'feels' like a commercial 3D application.



Model created by Alessandro Chiffi/ONDdata Studio

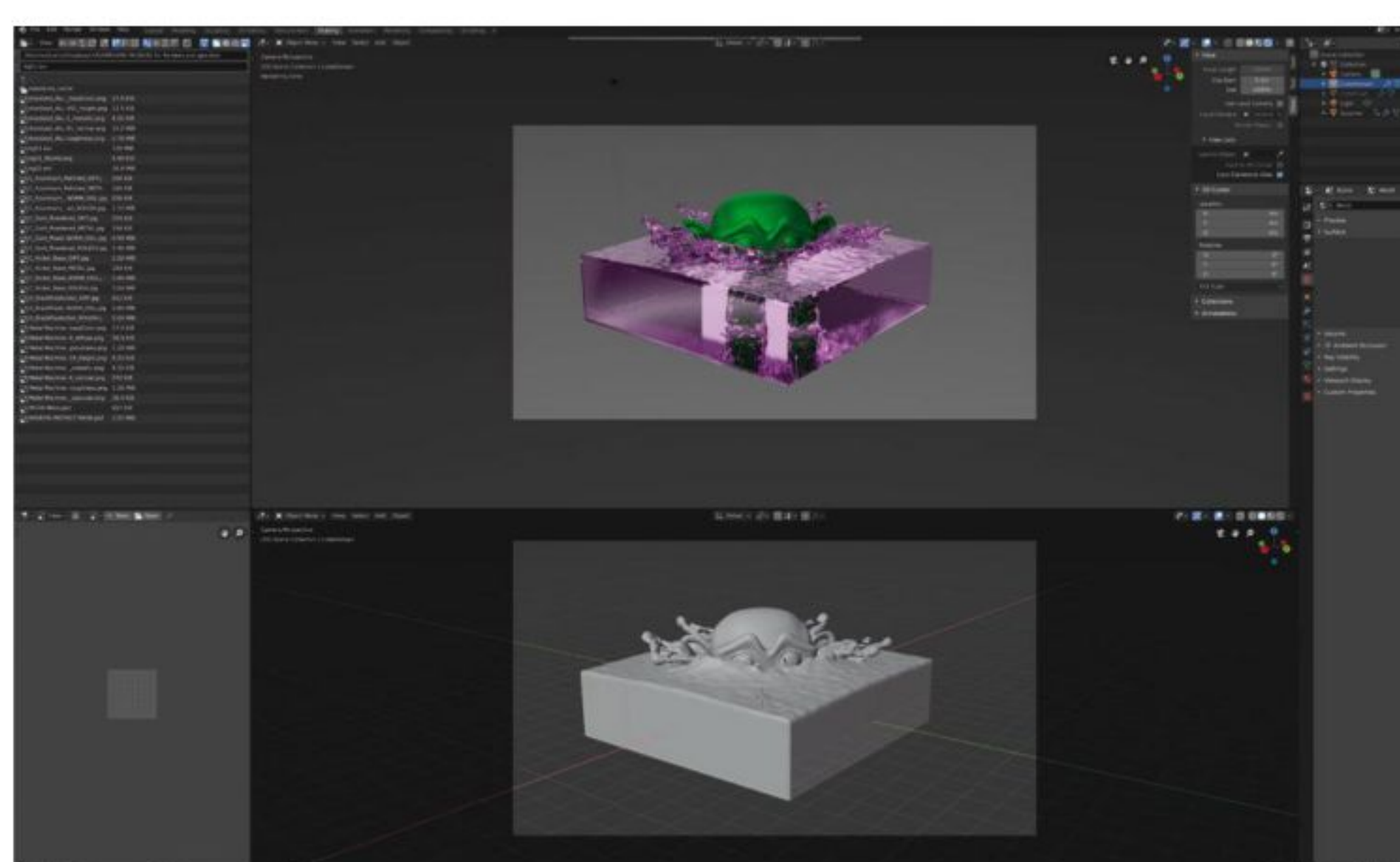
02 RENDER ENGINES

The render engines that come with Blender 2.8 are some of the best on the market. Cycles is a PBR-based render engine that can utilise a computer's CPU and GPU. In Blender 2.8, Cycles is supplemented by the new EEVEE real-time engine, which along with improvements to the main viewport (workbench) and NPR (freestyle) render solutions means that Blender 2.8 can create practically any image. Third-party render solutions also exist, such as AMD ProRender, and Octane with Redshift is coming soon.



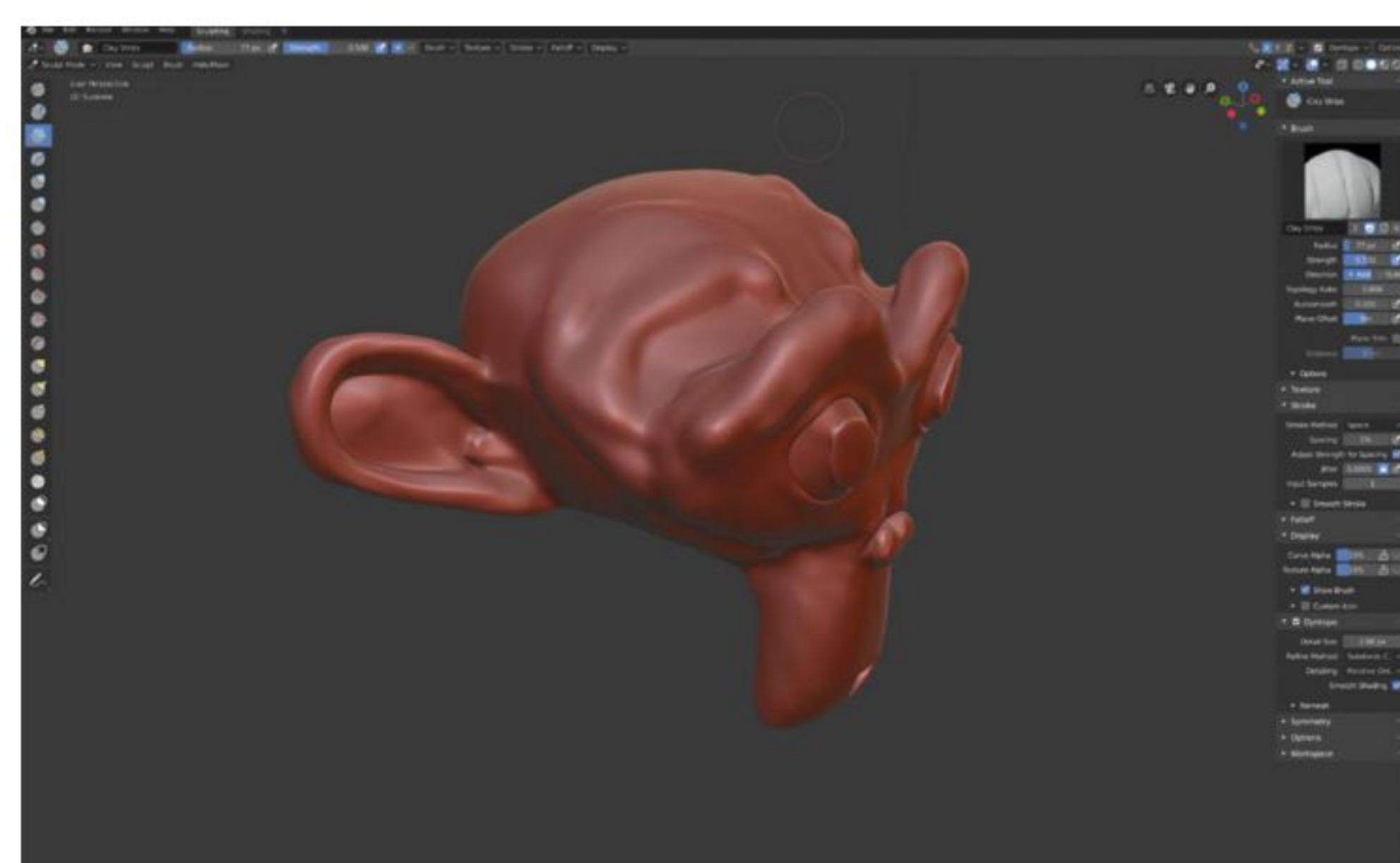
CUTTING-EDGE INTEGRATIONS

As Blender is open source, it is usually one of the first 3D applications to adopt new industry standards. For example, 2.8 supports the new industry colour format ACES, which, as it is adopted, will allow more simple colour management from the camera through post to finish. One of the best ways to contribute to this ongoing development while learning Blender is to buy products at the Blender store. Tutorials, clothing and many more products are available to purchase, and the revenue raised supports the Blender Foundation and its projects.



03 DYNAMICS IN BLENDER 2.8

Blender 2.8 builds on the already impressive toolset that previous releases of Blender had by properly integrating dynamics modifiers with the UI, making it simple to see which of the dynamics modifiers have been added. Blender has a full fluid sim, rigid and soft body dynamics and particle systems. As Blender can export and import common 3D formats such as Alembic, it means that Blender is an excellent addition for simulations if an artist's existing core 3D app does not support them.



04 SCULPTING TOOLS

Blender has one of the best sculpting engines available, with advanced topology tools such as Dyntopo that sculpts geometry onto a mesh without the need to subdivide the original model. As sculpting is deeply integrated within Blender, if an artist needs to use the other modelling or animation toolsets within the software, they are all available and the sculpt model does not need to be adapted, allowing dynamic creation of all aspects of a scene. •



3D BOOTCAMP

SUBSTANCE ALCHEMIST

Discover the next-generation material authoring solution from the team behind the Substance toolset

Texture creation is reaching a level of breathtaking artistry both in real-time and rendered CGI. The team at Substance have long been leaders in providing texture creation tools that can quickly create a material for new artists, while also having the deep toolset that is demanded by the latest AAA games and feature films.

Substance Alchemist, launching in November 2019, is the latest application from Substance and it provides an exciting new methodology for texture creation and management. While on the surface Substance Alchemist does not appear to have the depth of Substance Designer or

Substance Painter, that would be doing Substance Alchemist a disservice. Substance Alchemist offers a totally new methodology for creating tileable materials from either an artist's asset base or from the excellent Substance Source material archive.

Substance Alchemist offers an easier way into material creation for artists of any skill level than any Substance app before it. Substance Alchemist replaces Bitmap2Material, which allowed a new material to be created from an image via a drag-and-drop workflow from practically any image source. Substance Alchemist improves this texture workflow significantly, allowing

the mixing and matching of user-created materials, pre-existing Substance materials and those from Substance Source to create unique textures in minutes.

Using a four-stage workflow comprising of Explore, Inspire, Create and Manage, an artist with Substance Alchemist has a complete toolset at their hands to create variations of a material based on any image, and mix advanced materials together to make a material for any bespoke creation. As it is part of the Substance suite, Substance Alchemist is a free addition for most users of Substance products, and it deserves to be explored. Let's take a look!



AUTHOR

Mike Griggs

Mike Griggs is a 3D and visual effects artist with vast experience across the industry, as both a creator and a technical writer.

www.creativebloke.com



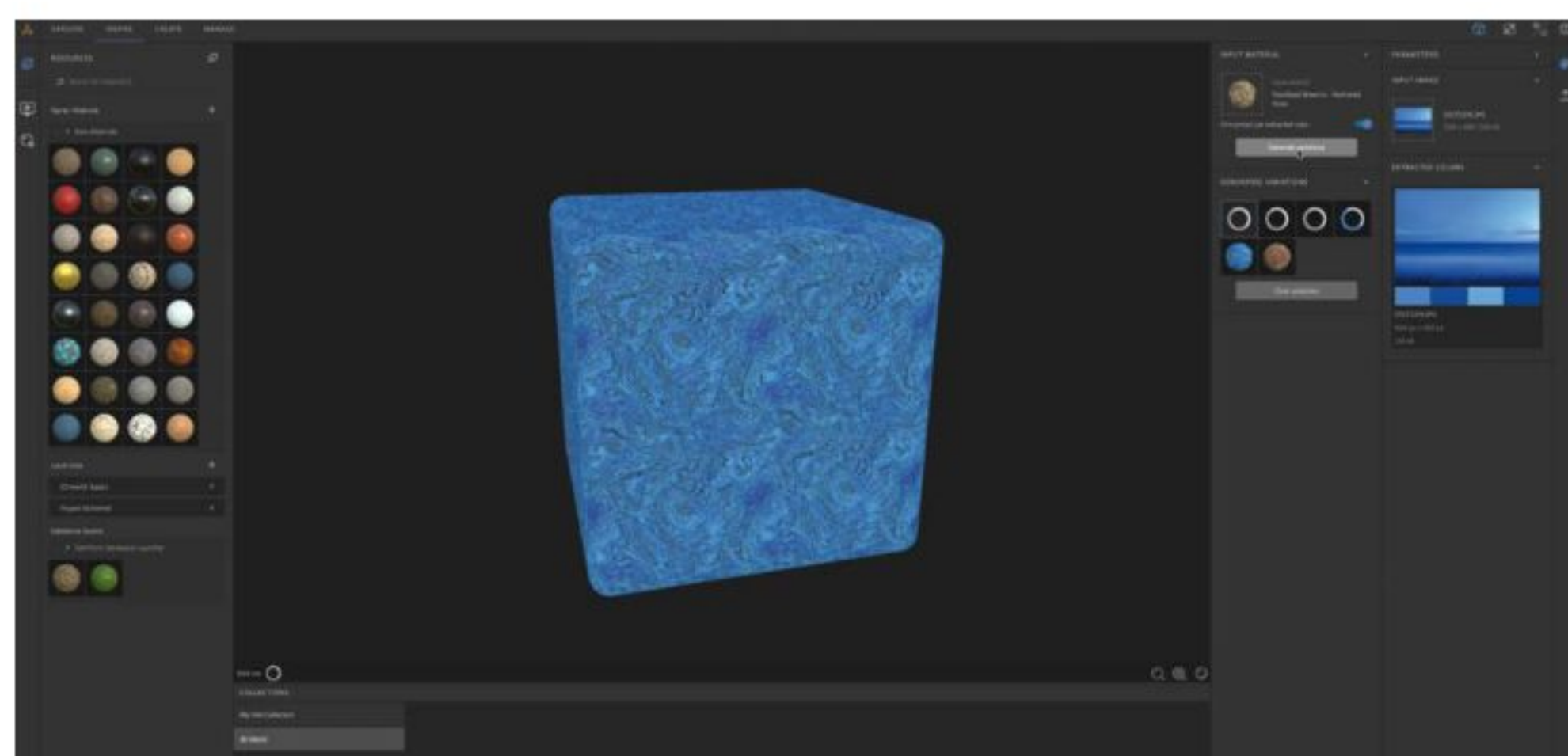
01 THE SUBSTANCE ALCHEMIST INTERFACE

The interface is broken down into three distinct categories: Explore, which allows you to browse through the materials available from a variety of sources; the Inspire tab, which allows an artist to create variants of existing materials; and the Create tab, where the majority of material creation and blending occurs, either from existing Substances or imported resources. (Note that images were taken with a beta version of Substance Alchemist.)



02 THE EXPLORE TAB

The Explore tab of Substance Alchemist is the first stop that any new artist should make. Here an artist can look at their Substance resources and decide if they want to proceed with what is available from the preloaded Substance Alchemist Starter Materials, from their own local disks, or Substances that have been side-loaded into Substance Alchemist via the Substance Launcher. Alchemist can also create 'Collections' of materials within the application.



03 THE INSPIRE TAB

This tab allows a variation of an existing material from a source image file. This can be a great way of creating variation from concept art where a standard material is embodied with the colour from the imported artwork. Substance Alchemist can make a variation based on a series of the four main colours in an image, or it can generate an individual variation based on one of the main colours. Each variation can be stored into a user's collection.



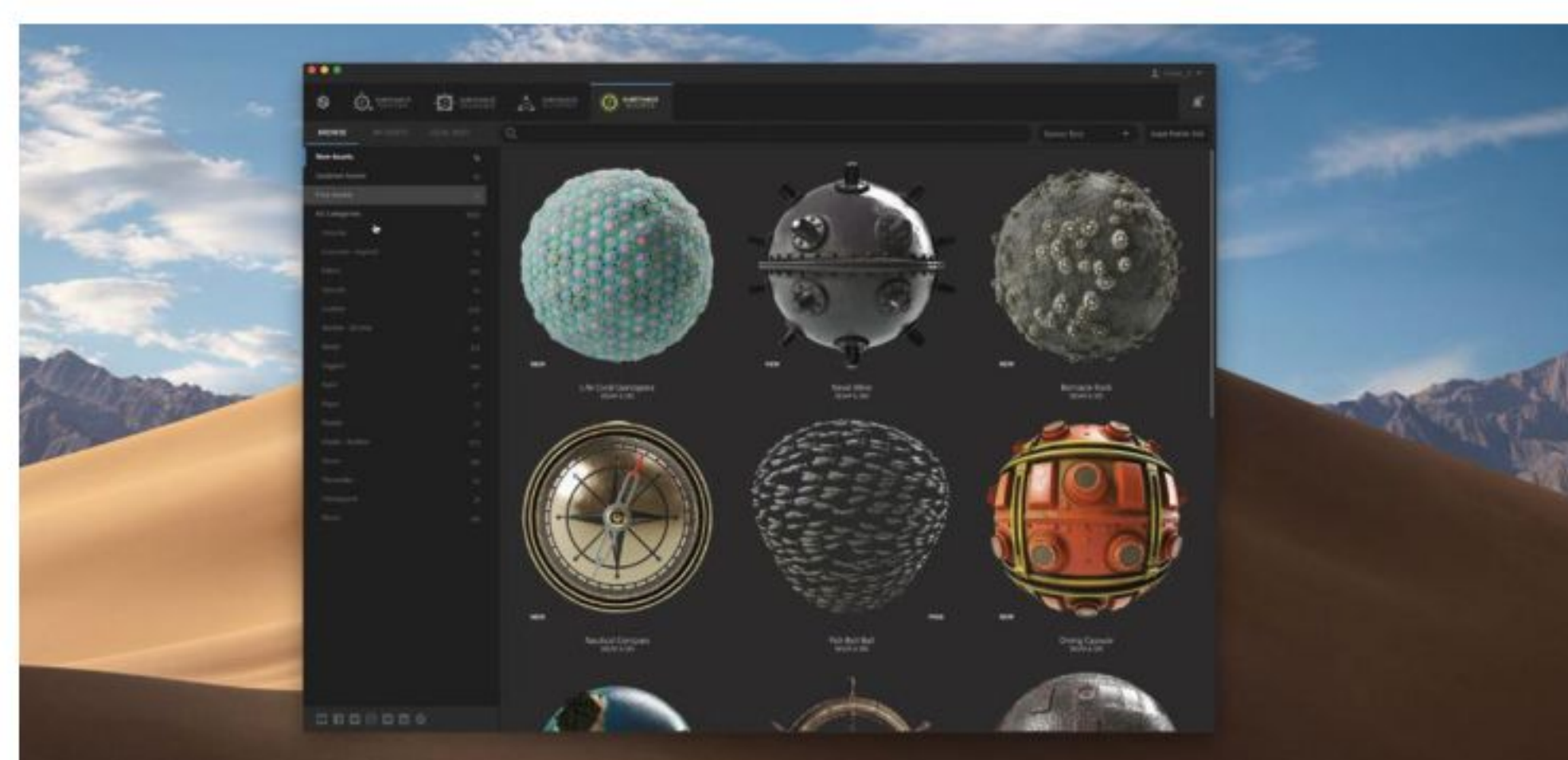
04 THE CREATE TAB WITH IMAGES

The Create tab is where the heavy-duty work is done in Alchemist. Substances or images via the importer can be loaded into the Create tab. When an image is imported, Substance Alchemist can create a full material with normal and depth information, and improves upon the Bitmap2Material workflow with the ability to create easy tiling setups with clone patches, without having to roundtrip to any of the other Substance applications.



05 THE CREATE TAB WITH SUBSTANCES

When an image has been through the Substance Alchemist workflow, it can be saved as a material and then, in the Create tab, mixed with other materials to create new bespoke textures. For example, wood and moss textures can be merged together and, using Substance Alchemist's toolset, can be mixed using properties inherent within the materials themselves, such as curvature or ambient occlusion. Height depth can be varied as well.



06 USING THE SUBSTANCE LAUNCHER

The Substance Launcher greatly simplifies updating and accessing the Substance suite of applications. One of the best features of the Substance Launcher is that it treats the Substance Source collection of materials as equal to the Substance applications, and therefore offers the ability to send Substance Source assets directly into the Substance apps without having to download and then load them into the application. •

ARTIST Q&A

Practical tips and tutorials from
pro artists to improve
your CG skills



Cirstyn Bech-Yagher

Cirstyn has moved from Radeon's ProRender to the RizomUV team, where she does product management as well as modelling, UV mapping and tutorial writing.
www.twitter.com/cirstyn



Maya Jermy

Maya is a 3D artist and animator based in the UK. She started her career in 2012 remaking and animating characters for *Oddworld: Abe's Oddysee - New 'n' Tasty*.
maya jermy.artstation.com



Pietro Chiovaro

Pietro is an Italian 3D artist who creates 3D assets and environments, and is currently working on an open-source game.
pietrochiovaro.artstation.com



SOFTWARE: SUBSTANCE PAINTER

HOW CAN I MAKE SEAMS IN SUBSTANCE PAINTER?

Mark Booker, Oxford



Cirstyn Bech-Yagher replies

One of the things that can be a little time-consuming in Substance Painter is creating seams for stitching on clothing. Even though there are a lot of ready-to-use brushes and tools out there, as well as the wonders of the Lazy Mouse, it's faster and easier to create something once, which you can then just load as a Smart Material and simply tweak as needed.

And one way to do that is by using the UV Border Distance Generator rather than one of the Edge Masks from the Smart Generator shelf. For something as simple and lightweight as this, it's also overkill to

use the Mask Builder or Editor from the same Generator dropdown.

Using the UV Border Distance Generator will generate a mask based on the edges of your mesh. This means that to get proper results, you will need to do the proper prep work first, so make sure you have a reasonably tidy mesh and decently cut UVs.

As you may know, generators in Painter generate their output based on your current material set's UV island topology. The Balance option defines the balance of the border on the island, and it can cover the entire island or just a small

GET IN TOUCH

EMAIL YOUR QUESTIONS TO
rob.redman@futurenet.com



edge. Contrast defines the sharpness of the edge of the border, and Smoothness seems to control the distance from the island's outer edge. Distance controls the size of the border going inward.

Differentiating between stitching two fabrics together and adornment, a seam is where two pieces of stitchables meet, and can be raised and lowered. So all you really need to do to create a decent seam is to set the Generator to define the Distance from the edge and the Smoothness of the seam on a heightmap to get a good result out of the box.

In this example, a very low Balance setting was used; Smooth and a little filter TLC were set to do the heavy lifting. As Contrast can give a blocky result, keep that to a medium setting to keep it smooth for the heightmap – which needs to be kept shallow. For a raised seam, duplicate the layer, invert the heightmap before you broaden Balance and Smooth a little, so it looks raised, and tweak the filter settings before adding your stitching.

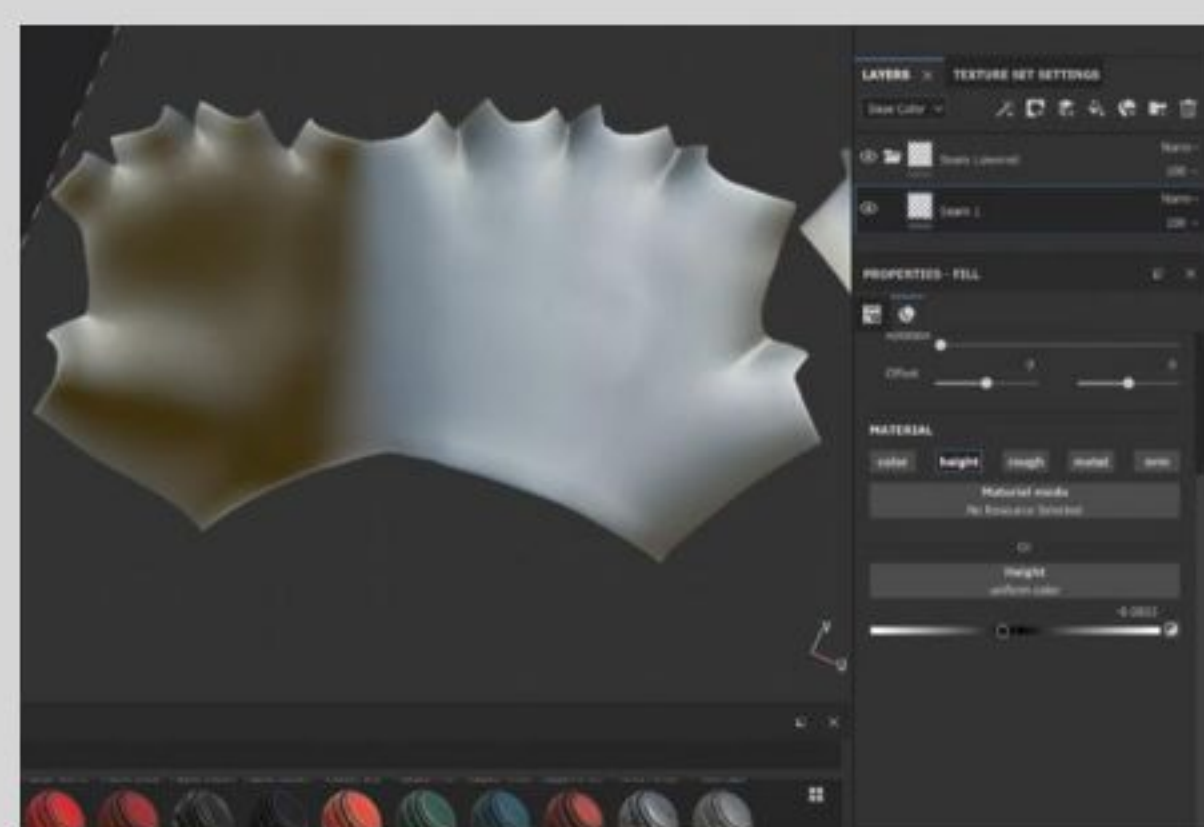
EXPERT TIP

RAISE THE SEAM

To create a raised seam, duplicate the layer and move the UV Border Distance sliders up in increments of 1. Set Height to a positive value. If you bake this out or use it as an anchor, it's now much easier to mess up a seam via a bake and further filters and effects.



STEP BY STEP USE THE UV BORDER DISTANCE GENERATOR

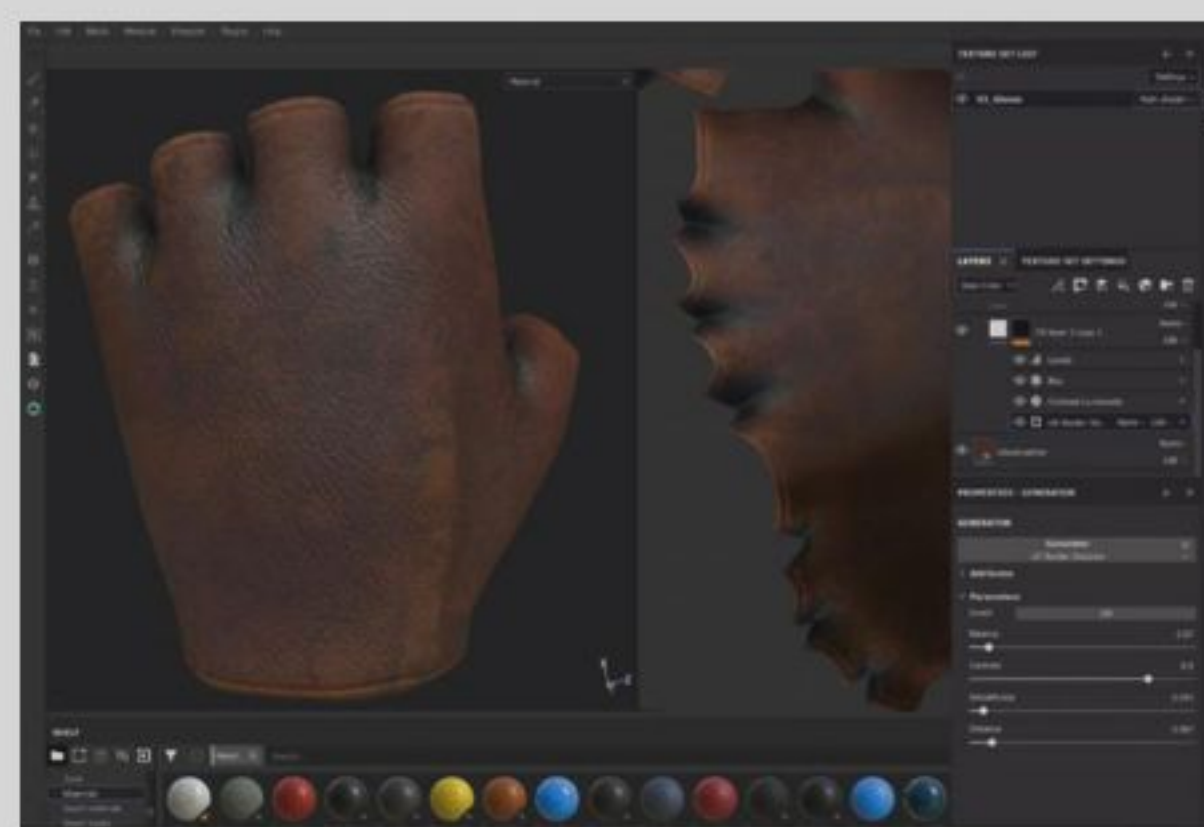


01 SET UP THE LAYERS

Import and set up your asset in Substance Painter, and bake any maps you may need. Create a folder in Layers and call it Seam Lowered. Add a Fill layer into the folder. Add a material if you don't like working in greyscale, and call it Seam. Turn off all channels bar Height. As you're going for a lowered seam, set the Height channel to a negative value, in the example it's set to -0.5076.

02 ADD THE GENERATOR

Add a Black Mask to the Seam layer. Right-click and select Add Generator. Click Generator and pick the UV Border Distance Generator. You won't see anything out of the box; tweaking Balance and other settings will make it show. In the example, Balance is set to 0.07 as it needs to be very thin. Contrast is set to 0.83, to avoid the jaggy and disappearing edges of setting it to 1.0.



03 REFINE THE SEAM

Set Smoothness to 0.06 and leave Distance no higher than 0.1. Experiment with all sliders to see what suits your model. To refine the seam, add two filters: click the Add Effect button and select Filter. Pick Contrast/Luminosity and tweak the sliders, so the seam looks smoother. Add a Blur filter if it's still too sharp, and set it very low – in the example it's set to 0.06. Add Levels for final tweaking.

04 ADD STITCHES

If you don't have a stitching brush, use the Brush Maker in the Alphas shelf. Set Alpha to Stitch Generator and set stitch type to Line. Scale X and Y according to your needs, and set Follow Path to On. Add, for example, Substance Source's Manila Rope as Material. Save as Tool or Brush, depending on whether you want to keep the material or not. It's even easier to follow your seam with Lazy Mouse on.

EXPERT TIP

LOCK THE START AND THE END

It is useful to lock the start and the end of the curve in place to avoid accidentally pulling them when editing the curve shape. Go to Stroke>Curve to activate those options.



SOFTWARE: ZBRUSH

IS THERE A QUICK WAY TO CREATE PETALS IN ZBRUSH?

Sharon Reynolds, Leicester



Maya Jermy replies

In order to sculpt something quickly in ZBrush, we need to understand the tools we have available that allow us to cut corners and work more efficiently. We also have to take the project idea and break it down to the main components to assess and plan the workload ahead.

When it comes to making 3D flowers, we usually focus our attention on the most

visible petals, leaves and stem. Petals are the centerpiece, they grab the most attention and may seem to be the hardest or time-consuming to make. Imagine having to create a composite flower, like a sunflower, and making all those petals individually. It would not be efficient or at all enjoyable. Thankfully, there is a way to create a lot of them in no time at all with the use of the CurveTriFill brush. It will cut

in half the time otherwise spent creating every petal individually. You can activate the CurveTriFill brush with the BCW keyboard shortcut. A thing to bear in mind is that this brush works with triangles, so depending on the project, it will most likely require a new topology.

Let me show you how to create a simple flower that will make a good base for a more elaborate floral creation.

STEP BY STEP CREATE A FLOWER IN ZBRUSH

01 BASE MESH

It's important to note that the CurveTriFill brush can only work on a model with frozen or no subdivision levels. Make sure the base mesh is ready before attempting to use the brush.

02 RADIAL SYMMETRY

Choose the brush (Keyboard BCW) and go to Transform>Activate

Symmetry>Radial, and choose the amount of instances you need to create. Draw out a curve to create the petals.

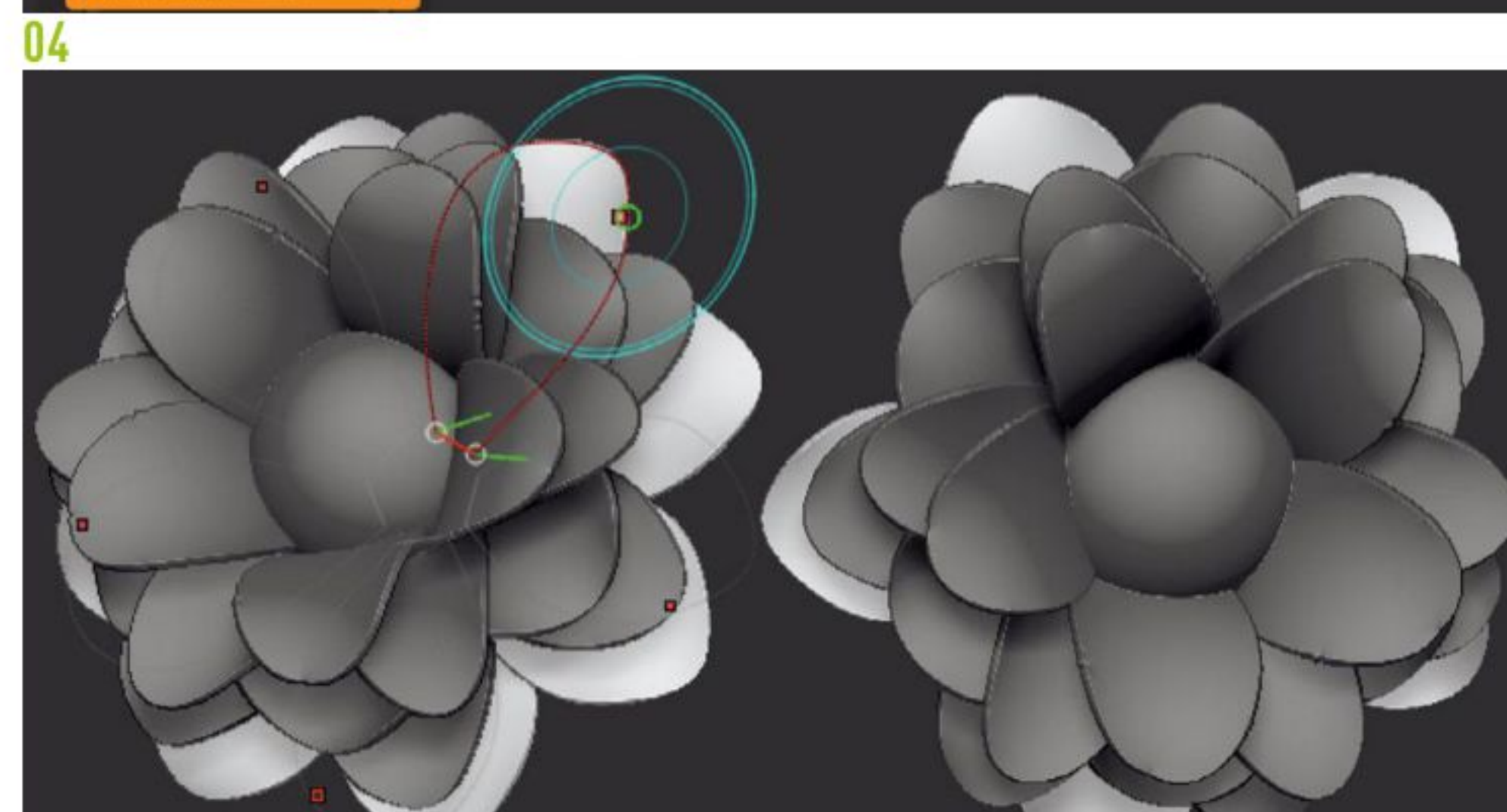
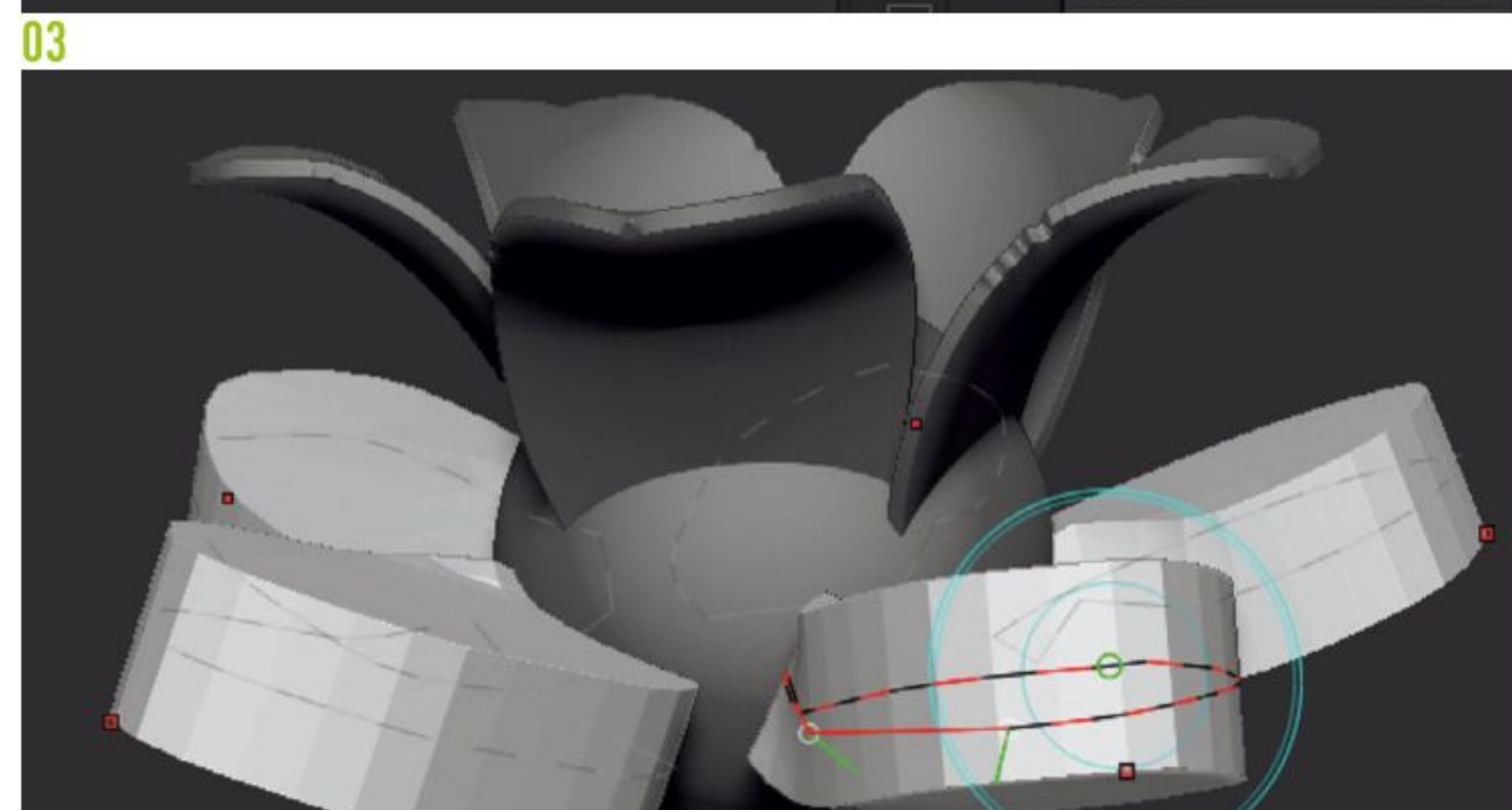
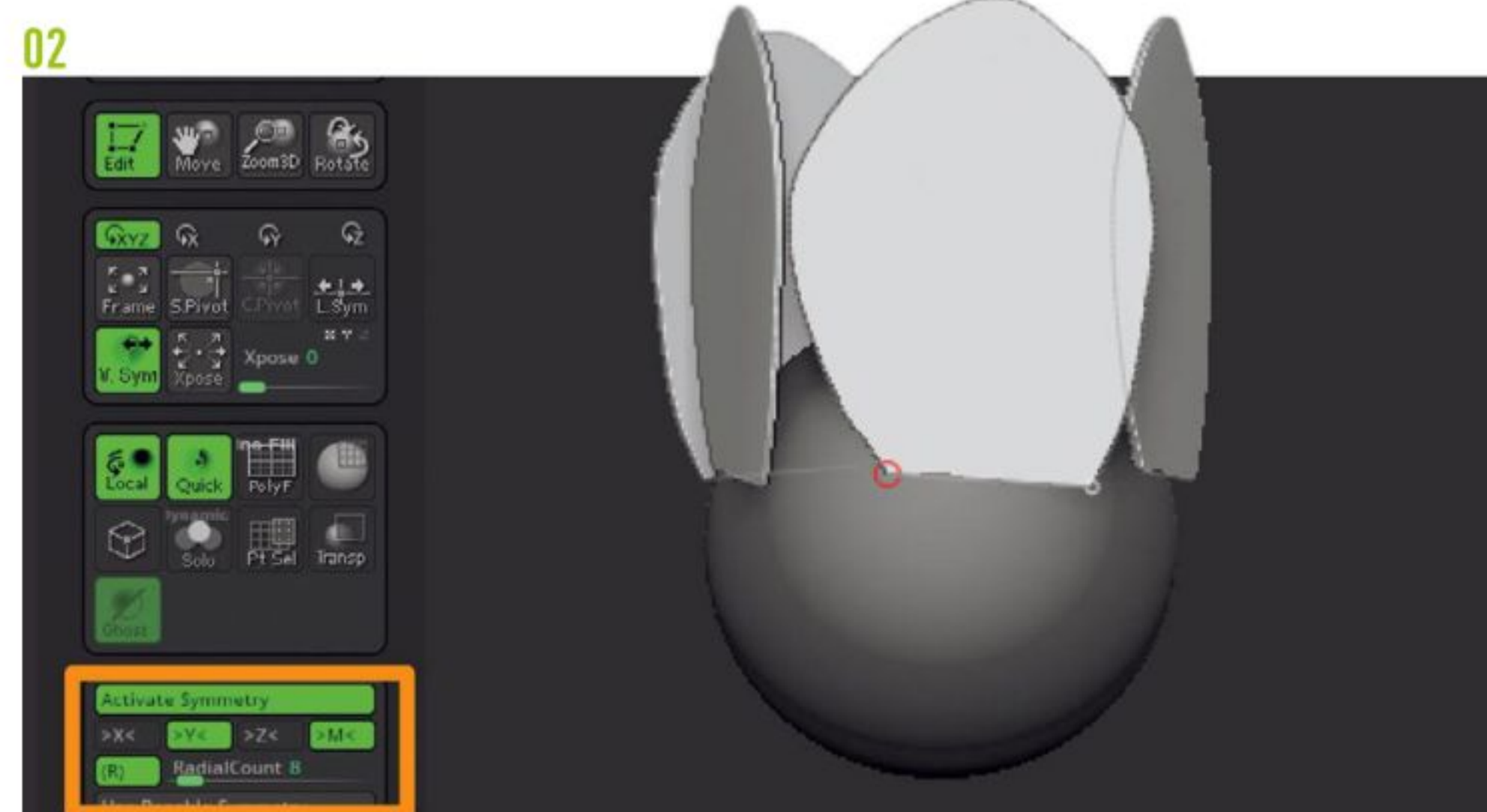
03 THE CURVE

You can alter the start and end position of the curve, circles on each end of the curve, or even reshape the petals by pulling on the curve line. You only need to adjust the original petal for the instances to update too. Notice

that the thickness of the created geometry is based on the brush size.

04 INSTANCES

At any point you can change the amount of instances by adjusting the radius number and clicking on the active curve. As long as you stay in this curve edit mode you can tweak the shape and proportions of all petal instances at once.



SOFTWARE: SUBSTANCE DESIGNER

HOW CAN I CREATE A CLAY POT MATERIAL USING SUBSTANCE DESIGNER?

Pierre Dubois, Paris



Pietro Chiovaro replies

I will show you an easy and really powerful way to create a clay pot material using Substance Designer. For this type of substance, I selected the Physically Based (Metallic/Roughness) Graph Template and deleted the Metallic output.

At this point, we can start to add the nodes necessary for this material, so from the Substance Designer library we need: the BnW Spots 2 and Cells 3 noises, the Height to Normal World Units filter, three Levels filters, a Blend filter, the Gradient Map filter that will give colour to the substance, and the Warp filter, a key element that will help us to mix the two noise generators.

Next we have to link all of these together. First of all, we need to link the BnW Spots 2 noise to the Gradient Map, and we have to link this filter to the Base Color output. Then we have to link the previous generator to the first Levels filter. Here we have to decrease the contrast until the noise appears as a white texture, then this filter must be linked to the Warp filter in the Gradient input, and to the Foreground input of the Blend filter. In the main input of the Warp filter, we have to link the Cells 3 generator, then the Warp can be linked to the second Levels filter – this element must be linked to the other two inputs (Background and Opacity) of the Blend filter. Now we can link the Blend filter to the Height output of the Height to Normal World Units filter, which will be linked to the Normal output.

Last but not least we have to link the BnW Spots 2 generator to the third Levels filter. This filter must be set in order to achieve a grey texture, which is really important in order to create a realistic clay pot roughness (this filter must be linked to the Roughness output).

I created an orange gradient for the Base Color, while for the Height to Normal World Units filter I set Surface Size 70cm and Height Depth 1cm. Since I will use this material in Unity and Blender, I selected OpenGL format. The other parameters for the two noise generators can be tweaked as you prefer, I kept the default values.





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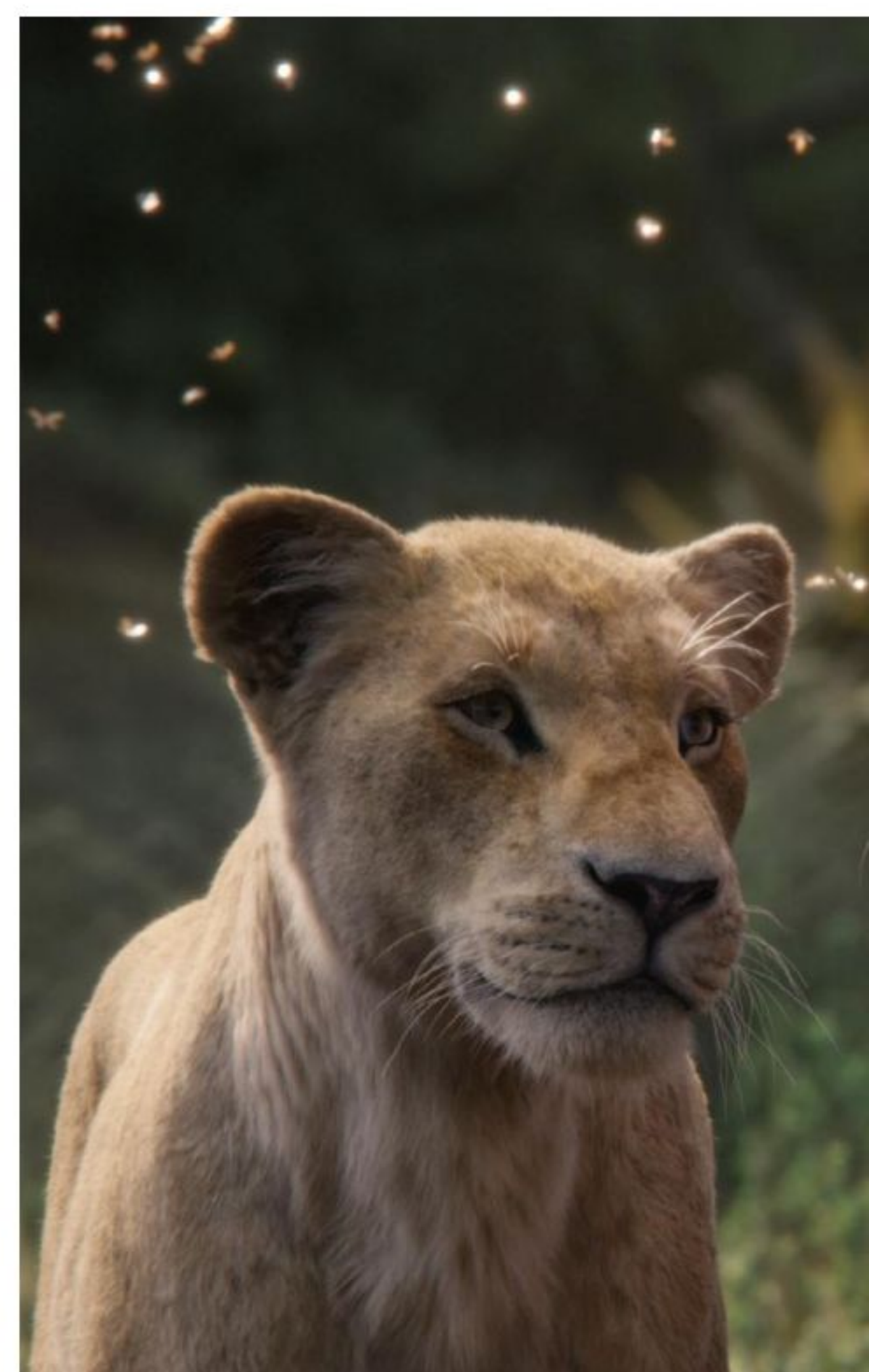
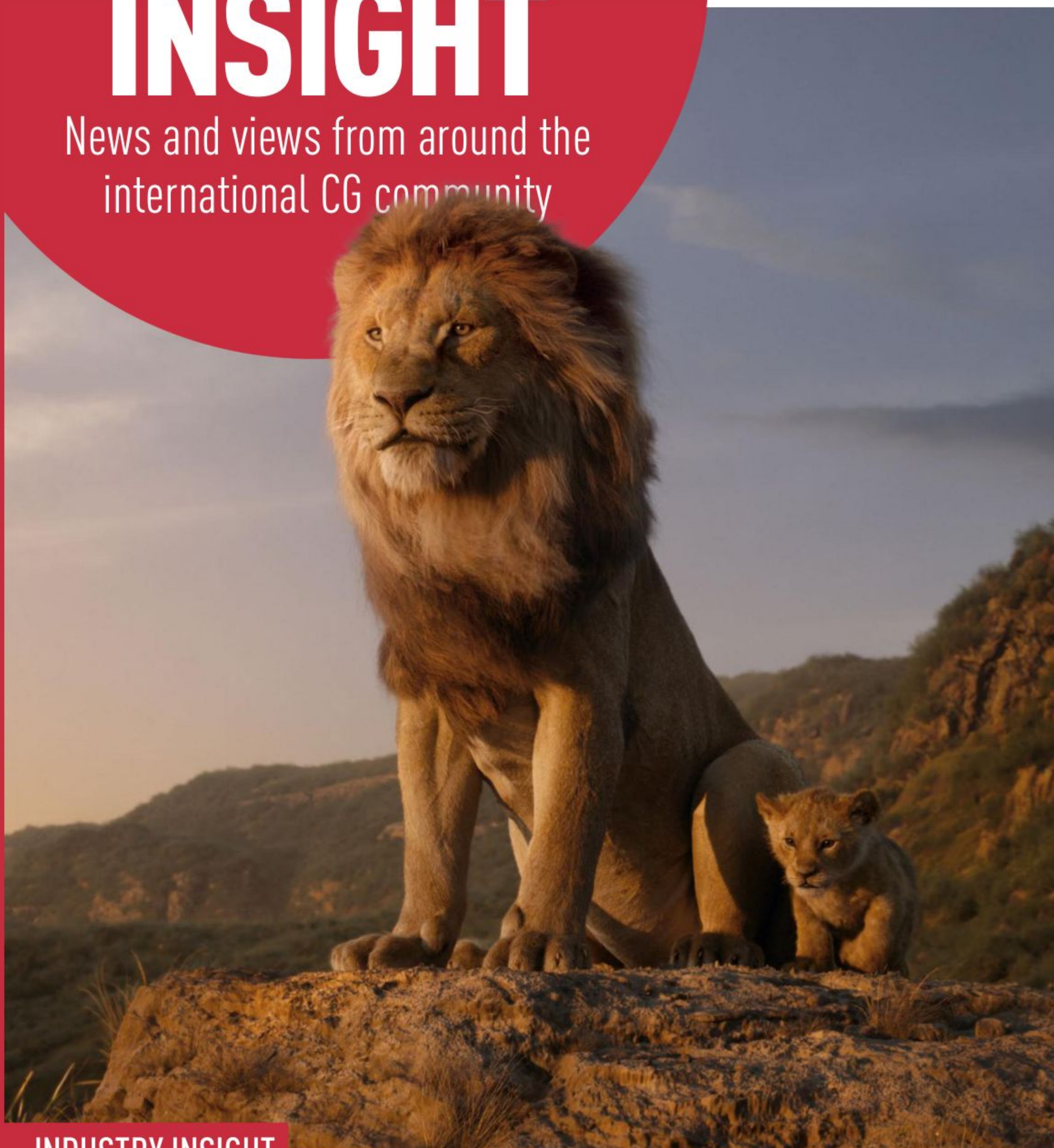
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INSIGHT

News and views from around the international CG community



INDUSTRY INSIGHT

The circle of life

VFX supervisor **Rob Legato** reveals how his career led him to redefine photorealism for Disney's *The Lion King*

A pioneer of Hollywood visual effects, Rob Legato has been creating the impossible onscreen since 1987. He has bagged three Oscars for his work with James Cameron, Martin Scorsese and Jon Favreau, as well as a BAFTA for his achievements on *Apollo 13*.

"I didn't initially try to get into visual effects at all," he tells **3D World**. It wasn't until he saw Francis Ford Coppola's seminal crime film *The Godfather* that Legato had any appreciation for the craft of filmmaking. "I wanted to do whatever I was seeing on the screen," he adds. "One of the first people that I could make a connection

with in the credits was Gordon Willis, the cinematographer."

Inspired by the magic of how images are created, as well as their ability to move the audience, Legato decided to study cinematography, and bagged a job producing live-action commercials. "The logic of movie making was something I had a particular intuition for," Legato continues. "One day a visual effect came up and there wasn't people like me that you could just call to set back then. So I figured out how to do it."

Despite intending to become a director, Legato found himself becoming something of a go-to guy for visual effects in live-action commercials, his creativity and efficiency

impressing many in the emerging field. It wasn't long before his talents were sought in the world of small-screen entertainment. "There was a TV show called *Twilight Zone* and it was about to go into its second season. They were adopting video post-production, which was foreign to a lot of the people working on it."

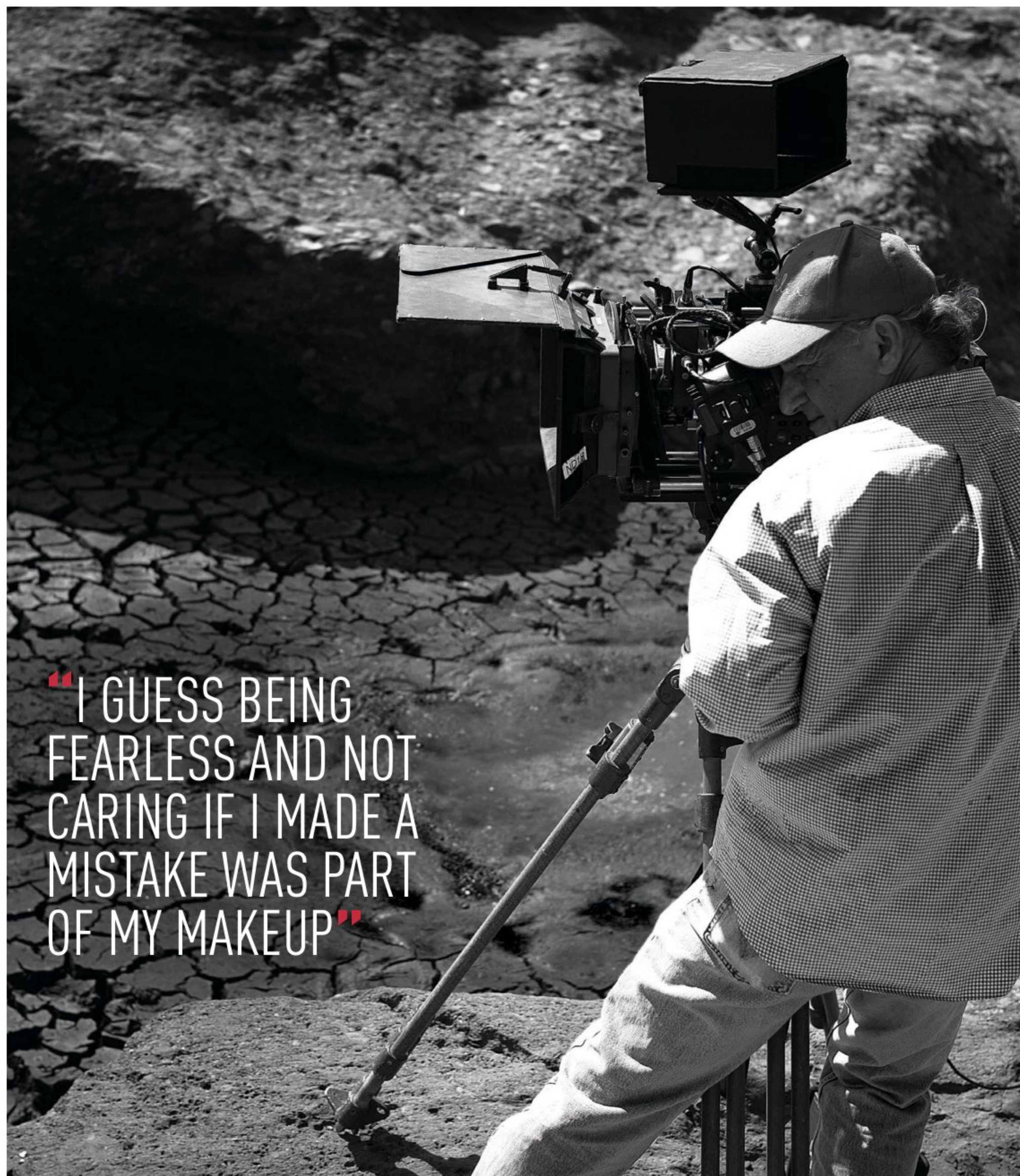
Legato was able to apply his methodology to this revival of the supernatural anthology series up until its cancellation. His unique skill set was then handpicked for *Star Trek: The Next Generation*, of which he would go on to direct several episodes. "I'd impressed a friend of mine who was in talks with James Cameron, Stan Winston and Scott



One of the reasons Favreau hired Legato for the remake of *The Lion King* was for his expertise in photorealistic CG

Legato maintains that the key to achieving photorealism is not in what you film, but how you film it

Having directed several times throughout his career, Legato is a member of the Directors Guild of America



“I GUESS BEING FEARLESS AND NOT CARING IF I MADE A MISTAKE WAS PART OF MY MAKEUP”

Ross,” Legato recalls. “They were forming Digital Domain at the time and they hired me right on the spot.”

With Hollywood beginning to fully embrace digital post-production techniques, Legato’s know-how was of increasing value to its top directors. “My first job was *Interview With The Vampire*, and director Neil Jordan asked me to be the second unit director as well.” This impressed Ron Howard who hired Legato to work on *Apollo 13*, which in turn impressed James Cameron and the pair embarked on *Titanic*, for which Legato won his first Academy Award. “It was kind of lucky breaks, being at the right place at the right time,” says Legato. “I guess

being fearless and not caring if I made a mistake was part of my makeup.”

This approach would carry Legato to the forefront of visual effects, where he would continually push the envelope. “I was doing *The Aviator*, it was a very lucky break for me to work with Martin Scorsese, and I had to do a plane crash, something I’d never shot before.” Never one to back down from the challenge, he used MotionBuilder to construct previsualisations of the sequence. “By the time I presented it to Marty it looked like a finished piece of creative work,” he continues. “I had eliminated all of the mistakes that I would have made had I went with my first idea.”

The plane crash sequence went so well that Legato took the idea to James Cameron. “He had a lot of money and he likes to do the stuff I like to do,” he adds. “He’s very hands-on, smart and has a penchant for visual effects.” Cameron had resigned himself to the fact that technology may not allow him to make *Avatar* for quite some time. “I showed him that you could use this process to direct a film in the way you like, but inside the computer,” explains Legato.

Avatar went on to be a colossal hit, alongside the virtual cinematography pipeline that helped make it, which Legato used on a number of projects including *Hugo*, once again with Martin Scorsese. ➤

THE NEXT GENERATION

How Legato's virtual cinematography techniques could change cinema for audiences and creatives

Having cracked photorealistic visual effects with *The Lion King*, Legato is excited by the possibilities it holds for filmmakers: "You could apply it to anything. *The Revenant* was a very arduous film to shoot. Only having a couple of hours of light, rehearsing all day in the freezing cold. Now you can authentically create those images in a studio, and being comfortable allows you to push the envelope a bit more."

The ability to previsualise sequences extensively democratises the filmmaking discipline, allowing budding directors, cinematographers or visual effects artists to creatively explore ideas from the comfort of their own home.

To visualise *The Lion King*'s IMAX sequences, Legato created a virtual reality cinema. "We had the exact 3D IMAX movie theatre that you would play this in," he explains. "You can even have sound emitters that are in exactly the same place as the Atmos speakers, giving you that sensation that the sound is coming from everywhere." The ability to recreate experiences such as the cinema, concerts and theatre has a wealth of potential for the entertainment industry. "You're able to recreate these experiences," says Legato. "If you wanted to go see *Hamilton* but never could, you could finally experience it."

Each of these innovations is the result of sheer determination on the part of Legato and his team. "Ultimately what we did on *The Lion King* is force this to become a really credible tool so that we could make a better movie. Now somebody will take that, fly with it and make something truly great."

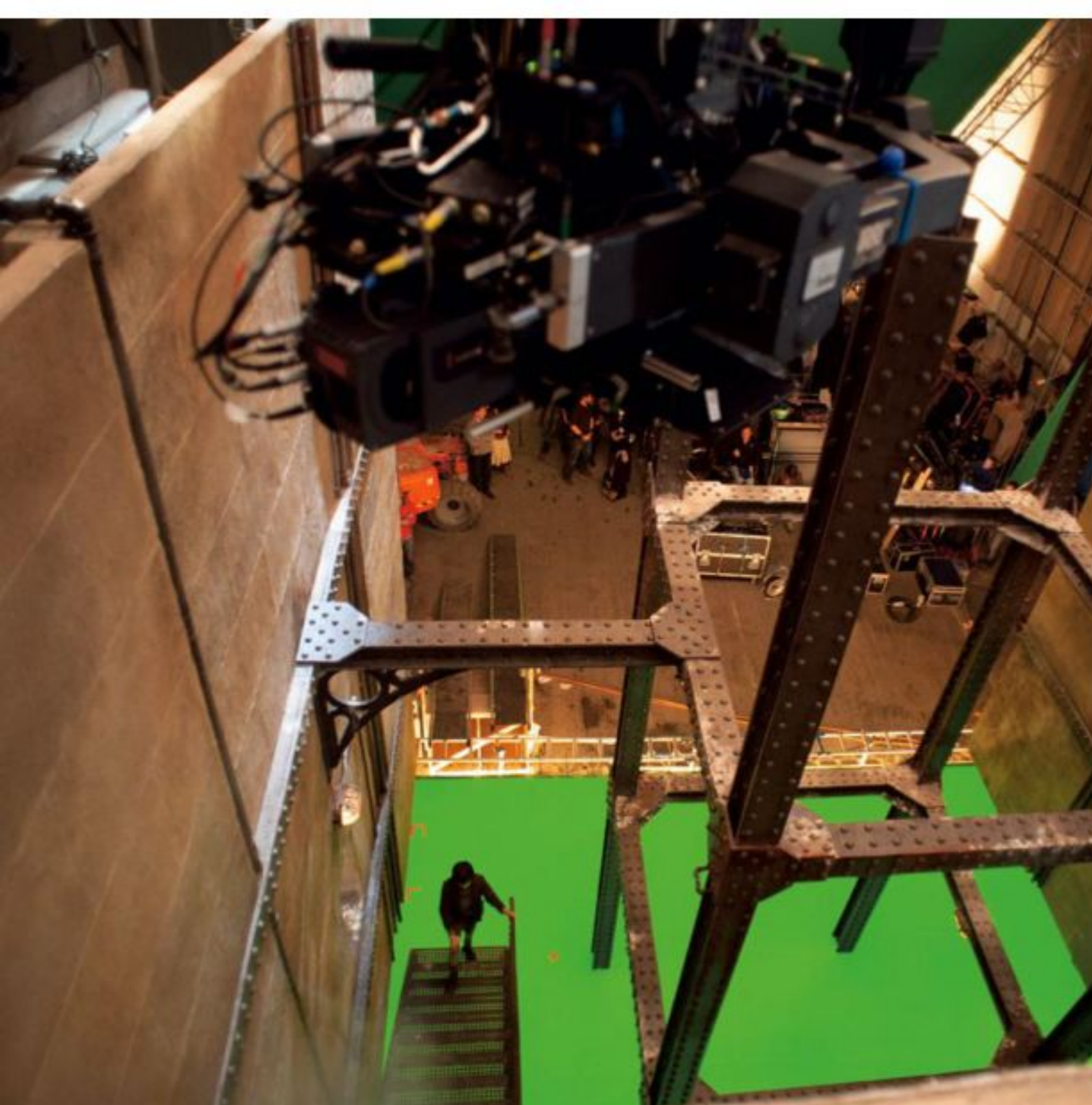




Far left: Legato on set of Martin Scorsese's 2011 film, *Hugo*, for which he won a second Academy Award

Legato says that any new technology offers more creative advancement to filmmaking than it does technical advancement

Below: 2016's live-action remake of *The Jungle Book* combined practical filmmaking techniques with Legato's virtual cinematography pipeline



➤ Intrigued by *Hugo*'s use of virtual cinematography techniques, Jon Favreau enlisted Legato to help create his adaptation of Disney's *The Jungle Book*. "That led me to working on *The Lion King*, where we came up with a better system. One that I had planned whilst doing *Avatar*, it's just the equipment wasn't up to it yet."

By the time the pair had finished work on *The Jungle Book*, HTC's VIVE system had begun to open up a world of new possibilities for virtual reality. When reuniting for *The Lion King*, the pair rebuilt the pipeline from the ground up. "We scrapped MotionBuilder and the rest of the stuff that goes with it," says Legato, "and started shooting in VR, whilst taking advantage of everything a game engine could give us."

Legato and Favreau share a passion for live-action filmmaking techniques, which they worked collaboratively to integrate into *The Lion King*. "The audience should forget we're doing it on a computer, they should just look and think we shot it for real," says Legato. The challenge of creating a photorealistic world populated by singing animals provided the team with a compelling reason to remake the beloved 2D classic.

"THE AUDIENCE SHOULD JUST LOOK AND THINK WE SHOT IT FOR REAL"

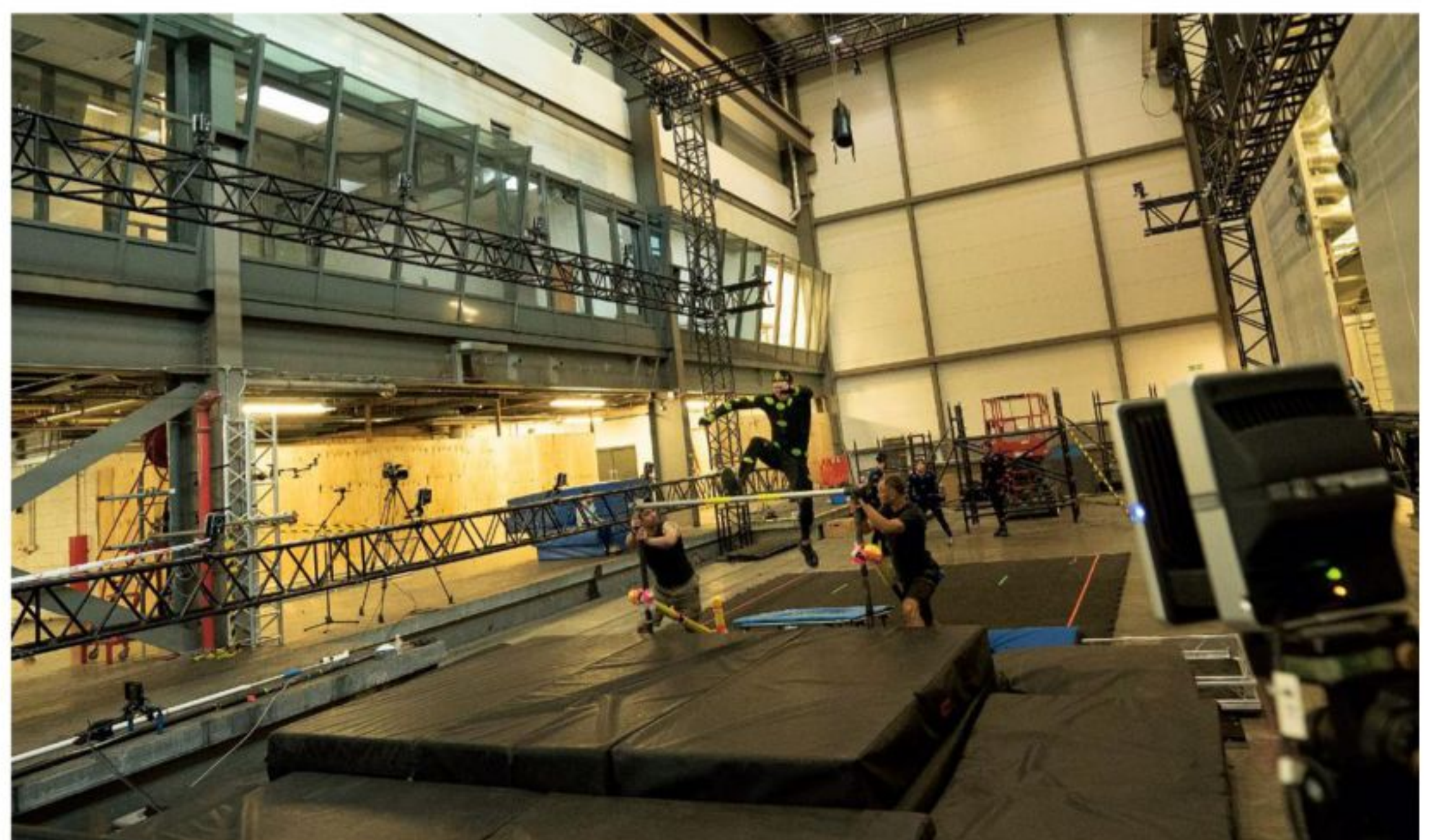
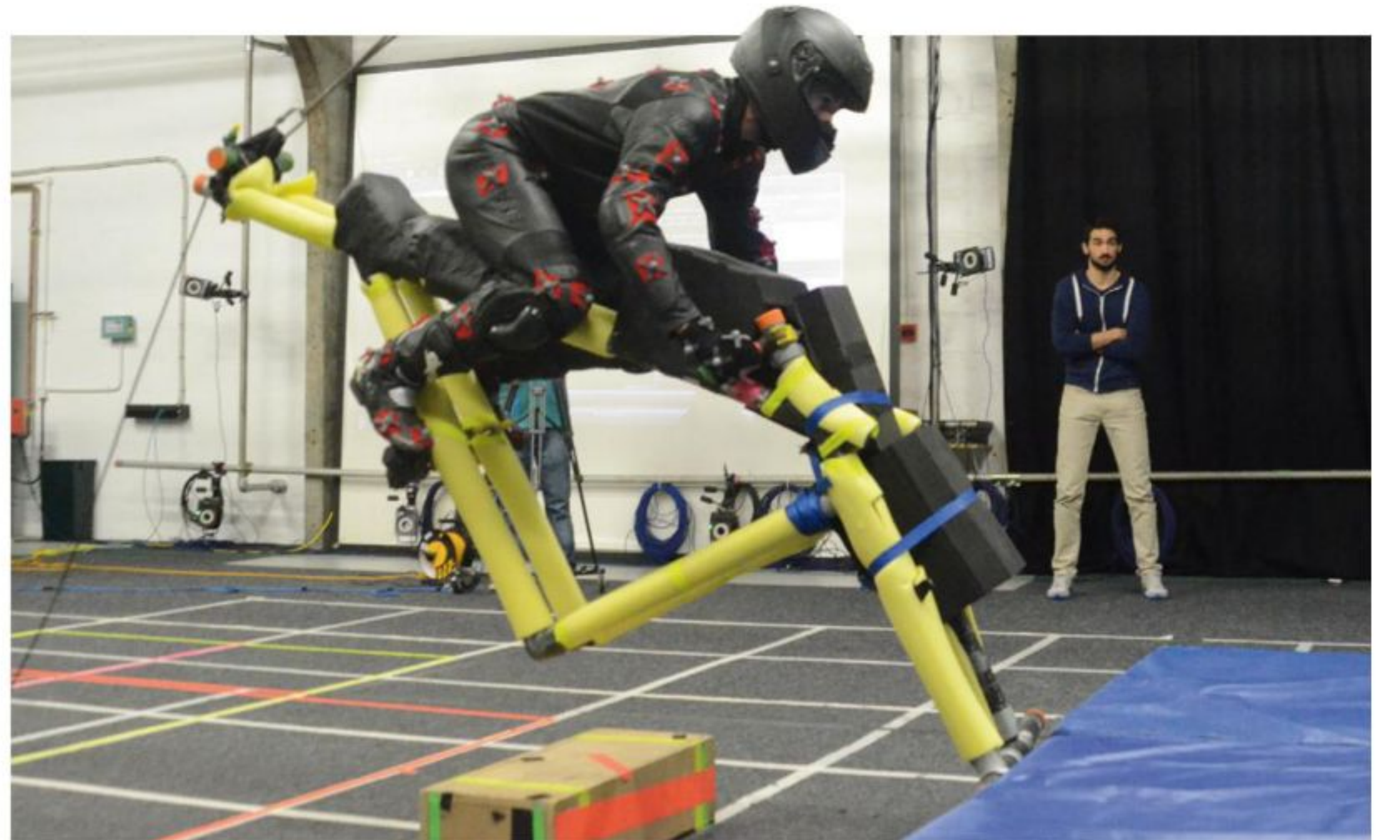
Rob Legato

"The hard part is that the stuff that's hugely entertaining in the original is cartoony," Legato continues. "You can get away with anything in a cartoon. Characters can suddenly have a hula skirt on and do a goose step and it still works. So how do we bring that back down to earth, yet still be entertaining? That's the challenge"

The result of *The Lion King* is another breakthrough for photorealism in visual effects, something Legato attributes to the talented team him and Favreau assembled on *The Jungle Book*. "I believe *The Lion King* looks as good as it looks because the same people that worked on *The Jungle Book* took what they learned and improved upon it," he explains. "MGM got really good at musicals in the 50s because the same group of people made them. They were motivated artists and they wanted to do better than before, then all of a sudden you're making stuff that no one else can do."



Audiomotion captured the skills of footballing stars for the *FIFA* video game franchise





INDUSTRY INSIGHT

The director's cut

Brian Mitchell, managing director of Audiomotion, fills **3D World** in on his career so far

Not only has Brian Mitchell been with Audiomotion since 1998, he has also been responsible for growing the technical capabilities of the company to become the largest motion capture studio outside the US. Along the way Audiomotion has bagged itself a world record and worked on countless blockbuster movies and AAA game titles.

"As with many things in life, the mocap career found me, not the other way round," Mitchell tells **3D World**. "I was the network guy at a company with a keen interest in photography. The opportunity presented itself when I, along with the rest of the team, was made redundant. So myself and three others decided to give it a go, and the rest is history."

Times have undoubtedly changed since Mitchell and his partners took their leap of faith. When they started out at the tail end of the millennium, Audiomotion's reference video was recorded on VHS tape. "Some clients had a tendency to put their IT guy in the mocap suit and hand him a wooden gun to run around with," adds Mitchell. "I'd say the quality of the performance

and the ability to see all the feedback in a real-time game engine has made the whole process far more professional." As well as having several large studio spaces to work from, the studio can also take their state-of-the-art capabilities on the road and capture on location.

Among the personal highlights of Mitchell's career are a who's who of famous actors and sports stars. "Top of my list is Liam Neeson," he recalls, "he's a true gent."

"THE ABILITY TO SEE ALL THE FEEDBACK IN A REAL-TIME GAME ENGINE HAS MADE THE PROCESS FAR MORE PROFESSIONAL"

Brian Mitchell, managing director of Audiomotion

Mitchell also reflects on the time he spent on set with the likes of Danny DeVito, Jack Black, and C-3PO actor Anthony Daniels. "Working with Lionel Messi in Barcelona when they won the treble was incredible," he continues, "and more recently with Ronaldo in Madrid."

Audiomotion has also captured the footballing talents of Harry Kane, Wayne Rooney, Gareth Bale, Dele Alli and Marcus Rashford. Musicians such as The Black Eyed

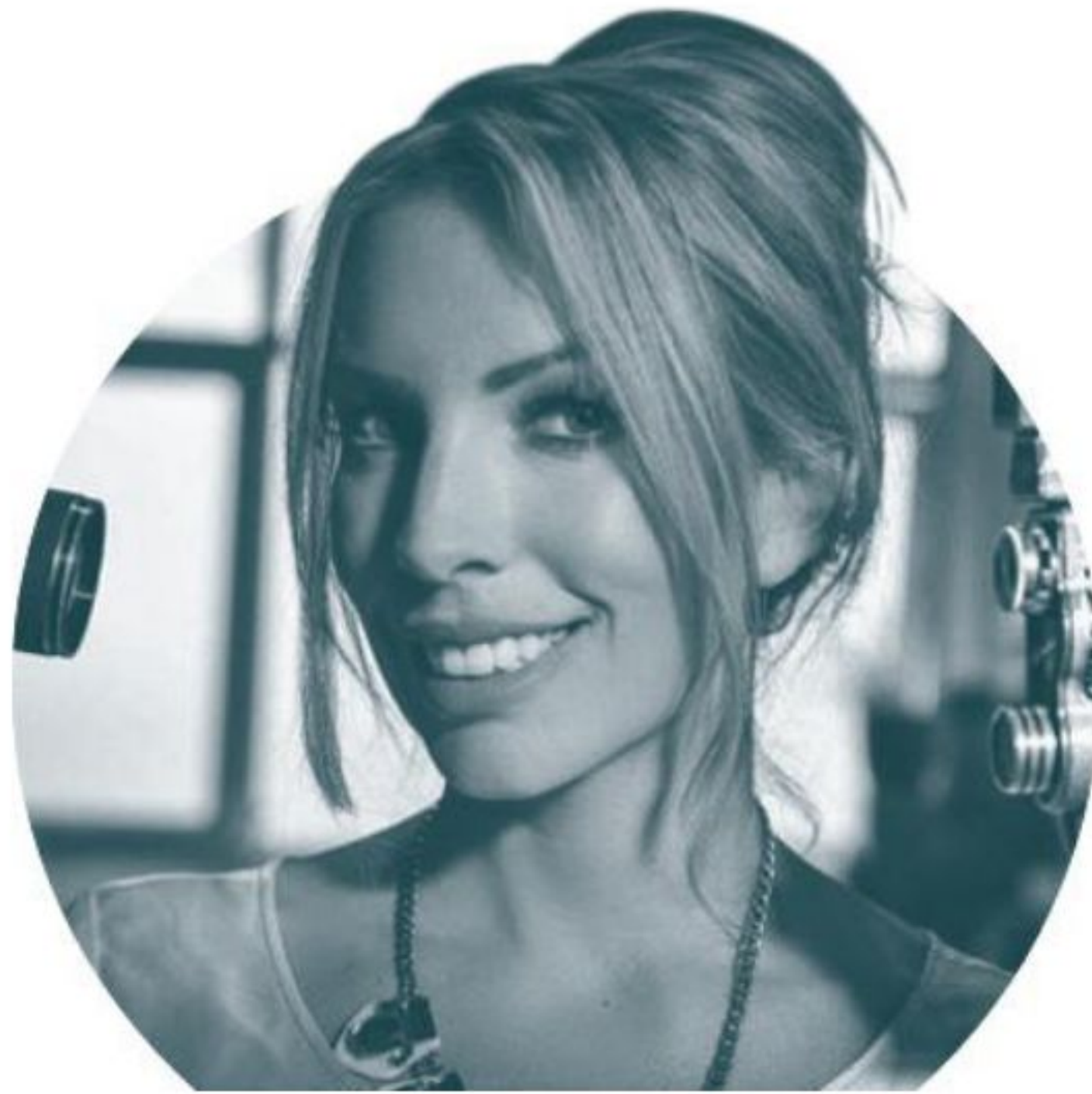
Peas, Robbie Williams and the Gorillaz have also benefited from the studio's technical wizardry. Mitchell continues: "Getting to work on a *Star Wars* movie and with Steven Spielberg on *Ready Player One* were absolute dreams come true."

Two decades in the industry has yet to dampen Mitchell's enthusiasm though, and he remains excited about the potential of virtual production to turn things on their head. "It's changing how we shoot movies," he explains.

"It's a coming together of the game industry and film making. We've been working in a virtual environment for a long time now and although the game developers have been exploiting the tech for some time,

it really comes into its own when used for film making."

When it comes to predicting the next two decades of motion capture, Mitchell is of the opinion that anything is possible. "At the rate we're going we'll be using mind control and having drinks brought to us by AI before we know we're thirsty," he says. "Or maybe markerless tracking placing actors and maybe viewers inside the virtual world, just like the original *Tron*."



PRO THOUGHTS

Animated woman: my journey to leading an animation studio

AWUK's board member Georgina Hurcombe discusses women's position in the animation industry and reflects on running a studio as a young woman

I founded LoveLove Films when I was 25 years old after being made redundant. I had been working in the industry for a few years, but the redundancy really knocked my confidence. Looking back now, it was one of the best things that could have happened to me, as it allowed me to consider my next steps. Full of passion (and naivety!), I decided to start my own business.

Through a combination of way too much coffee and a rented desk, I started to build my studio. In the early days of the company, I gained clients by approaching people, networking anywhere and everywhere, working around the clock and, most importantly, I'd like to think I was friendly.

Running a business wasn't always easy. I've found that it can be a lot like riding a rollercoaster; one minute you're on top of the world, and the next, it feels like the cart is about to fly off the tracks, but you take a corner and are riding high once more.

Things that I thought would never go wrong did go wrong. In my first office, the roof collapsed and we basically had an indoor waterfall! After that, I moved our team into an old Gospel hall that I had found for rent on Gumtree. It was beautiful, with

parquet floors and a stunning high ceiling, but it was also a bit of a mess. The old man who had owned it for over 30 years clearly hadn't maintained it, but it was the kind of space that I had dreamed about for the team. I put a deposit down, and within the first week the boiler broke down, and our roof started to leak (again!). The leaking roof then became the inspiration behind our music video for Joss Stone's *The Love We Had*, which went on to get over 11 million views online.

The next hurdle was when we were told that the building was being repossessed, as our landlord hadn't been keeping up with his mortgage payments. Again, full of naivety, I put in an offer to buy the building from him – which he accepted. I then had the daunting task of figuring out how to buy a building.

I spent days and days writing a 60-page business plan, detailing the reasons my local bank should help me buy this beautiful old building. I went into the bank and pitched my heart out for about 40 minutes, only to be told that he was only the man who helped me fill out the forms.

I pitched again to the regional bank manager a couple of weeks later. I was thrilled when they agreed to help me buy

the building. I spent months renovating it – including one unfortunate incident where I had to fix the sewage drain and got covered head to toe in... yep! Those were difficult times, but nearly ten years later I look around at our stunning, bespoke studio and laugh at the memories of me literally covered in poo.

Starting a business is challenging for anyone, but starting a business as a young woman came with its own unique barriers that I feel are important to raise awareness of.

I have certainly experienced many examples of sexism throughout my career, from being asked when my boss is joining me at a meeting, to being told that I could not attend a networking event because it was for "serious businessmen". I've often been to networking events where I was the only woman in the room. I remember one audio-visual event early on in my career – before I had started the company – where a client got very handsy. Luckily, I was with another colleague who had to physically pull the client off me and allow me to escape. When I, shaken, told my boss, he shrugged his shoulders and told me to try and avoid that client. I would love to be able to say that these things have completely changed since



Aardman have been appointed as the distribution partner for LoveLove Films' preschool series *Pop Paper City*, which encourages children to be creative

I started the company almost ten years ago, but unfortunately, many women experience similar obstacles themselves.

I feel very fortunate to now be in the position where I can pass on some of the advice that helped me get through the tougher points in my career to where I am now. Firstly, you have to be confident, no matter how hard this can be sometimes.

In the early days of LoveLove Films, there were times when I felt my confidence slip because of the barriers I too frequently experienced because of my gender. Being confident in your own abilities, as well as seeking out and taking advice is a winning formula.

Of course, this can be difficult – I recently read that over 6 in 10 women in the UK suffer from imposter syndrome. I have seen this so many times in my own friends, who ask me whether they are experienced enough to go for jobs that I know they are more than qualified for. I always tell them to just go for it – what do you have to lose? This has become a personal motto for me. I tend to go for things, and just ask people, because the worst thing they can do is say no, and if they do, it's not the end of the world.

One of the most wonderful things about this industry is the support networks available and the incredibly friendly atmosphere of the children's TV and animation industry. I have met some truly wonderful women who have provided me with incredible guidance as my business has transitioned from producing graphics and TV adverts into children's television.

"I TEND TO GO FOR THINGS AND JUST ASK PEOPLE, THE WORST THING THEY CAN DO IS SAY NO"

Georgina Hurcombe, LoveLove Films

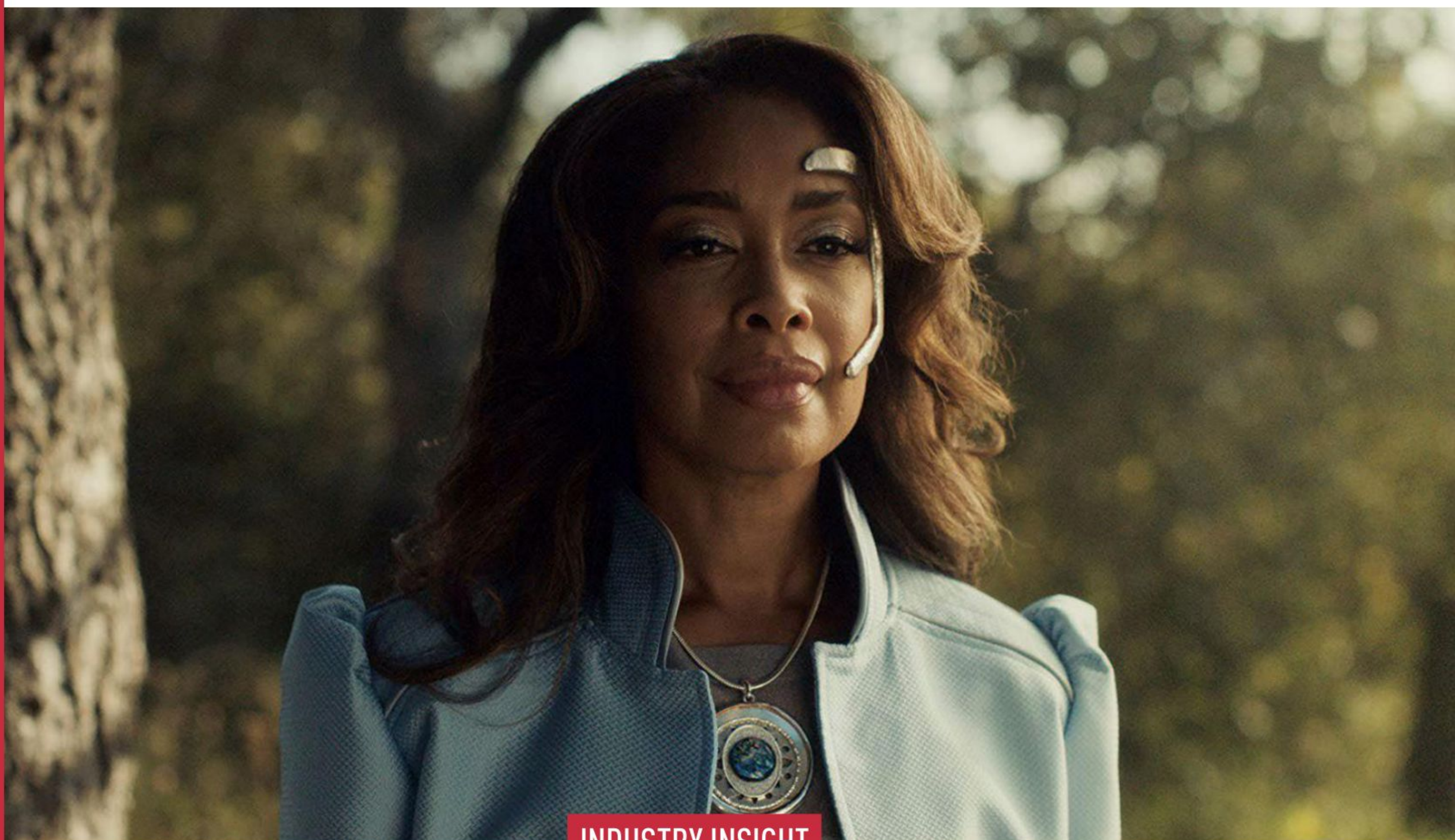
Organisations like Animated Women UK have provided me with amazing opportunities to meet more like-minded women in diverse stages of their careers. The Helen North programme introduced me to lots of women, from juniors entering the industry to senior women doing really amazing work in VFX and animation. My network has grown tenfold, not only with

new associates but with new friends too, and I have learned so much from these incredible women.

LoveLove Films recently signed a distribution deal with Aardman for our children's TV show in development, *Pop Paper City*, which has been a great step in the direction we want our company to go in. Again, I have had so much support from people in all areas of the animation industry, and it is lovely to feel like you have a network of people wanting you to do well.

To conclude, if you're a woman who works in animation or visual effects: seek out opportunities, surround yourself with people who are passionate, listen to advice, and don't stress out too much – I always tell my team "we're producing animations not saving lives". Most importantly, believe in yourself, surround yourself with a great team of people, and go for it.

Georgina Hurcombe is the founder and managing director of Bournemouth-based animation studio LoveLove Films. She became a board member of Animated Women UK in May 2019



INDUSTRY INSIGHT

Creating an out-of-this-world indie film

Director Kylie Eaton takes a look at the production of her new science fantasy short, *DISPEL*

In the age of Netflix and Amazon Prime there's an endless scroll of content for film fans to sift through. Yet, I still struggle to find female-centric shows that are representative of how people actually look in real life and sit within the science fantasy genre. This is where the idea for *DISPEL* first began. I saw a niche in the market that needed to be filled. After all, if you can't find the movie you want to watch, why not make it yourself?

DISPEL premiered at the LA Shorts International Film Festival in July 2019, with additional screenings at Indy Shorts, BronzeLens, Comicpalooza, Lady Filmmakers, Black Harvest and many more. The film is now free to watch online for audiences worldwide.

When ideas collide

The script for *DISPEL* came to life when two ideas collided. I wanted to tell a story about a young girl dealing with difficulties at home, while honouring the impact that sci-fi and fantasy films had on my childhood.

In *DISPEL*, when young Lizzie learns her older brother is moving out, she realises she will be left at home alone with her monster of a mother. This bond between siblings becomes a catalyst for everything that happens in the film, including the sci-fi elements. Lizzie dives into fiction as an escape from her difficult situation. That's what I did as a kid – I read a lot of books, watched a lot of movies, and completely immersed myself in those worlds.

Once you have that initial idea, it's important to sit down and start delving into who the characters are. I wrote their back

stories, got to know them and looked at how their paths might cross and conflict within the screenplay.

Next, look at the environments these characters inhabit. Building out your story in this way is especially useful in genre filmmaking. Having pre-written lore for your universe ensures that script writing will go much more smoothly. I researched films in the same genre to build up reference material, including the original *Star Trek* and *Doctor Who*, and this gave me a feel for that niche of pop culture.

Take *Star Wars: A New Hope*, for instance. You can learn a lot about the hero's journey, character development, and structure from that film. The filmmakers also showed a lot of ingenuity. They fused everyday items, practical effects and miniatures into this massive world-





Above: Concept art for the monster, designed for a smooth transformation back into human form once *DISPEL* entered post-production

Left: Invisible visual effects by Hi From The Future to create claw marks on Lizzie's arm that suggest a monster's attack



● INDUSTRY

Creating an out-of-this-world indie film

➤ building project. I tried to do something similar with *DISPEL*, designing trading cards around character history, and hiding Easter eggs in the set of Lizzie's room. Most of the planets, organisations and characters imagined in the *DISPEL* universe are never mentioned on screen, but they still exist behind the scenes.

Dream house, dream cast

Now I had built my world, I needed to root it in reality. Finding the perfect location for a blend of science and fantasy can be difficult, especially on a low budget. I absolutely knew our set had to be an early-century, two-story house, I could picture it in my head, but it proved difficult to find a typical home like this in LA. The important thing is to keep looking and ask around. Don't be afraid to intrude, or you'll never get anything done.

Once I find a location, I'm usually inspired by something in the space that will jog a new story idea. It's a fantastic payoff. I encourage all filmmakers to stay open to script changes at this stage, and listen to your actors in particular.

When I first came up with the concept of *DISPEL*, I had Gina Torres in mind as the actress behind Celeste. She's been a huge inspiration to me, both in terms of her career and personality. I always thought she should play a superhero character, we need to see more diverse superhero portrayals.

When sending out the very first casting call, I wanted to take into consideration the industry-wide issues surrounding representation of women and artists of colour in film. *DISPEL* consists of a primarily female, ethnically diverse cast. Behind the scenes, *DISPEL* also features female-majority department heads.

Rooted in production

After a whirlwind week on set, working with talented actors, we move onto post-production. My first job after moving to LA was actually as an assistant to the head of post production at Twentieth Century Fox Television. It's a skillset that's near and dear to my heart.

In order to grow as a director, you have to learn to edit your own projects in post-production. Watching through all the footage and actually putting it together into a cohesive story will teach you a lot about filmmaking – how to approach scenes,

arrange camera angles, build a shot list, plan CG elements and more. The challenges you face in post-production are often the best lessons in filmmaking.

**"WHEN I BEGAN TO
THINK ABOUT MY OWN
PASSIONS AND VALUES
MY FILMS TOOK OFF"**

Kylie Eaton

resource for this. It might take you longer to do something yourself than if you paid someone, but not only will it help your budget, it will also inform you as a

Don't be afraid to try to learn something new. Try your hand at being a generalist and learn a little bit of compositing, character modelling, particle simulation, or whatever skillset might be useful to you.

YouTube is a great

filmmaker ahead of your next project. Doing my own VFX on previous projects definitely helped me plan and shoot *DISPEL*.

Not to say you have to do everything by yourself, we worked with a company called Hi From The Future to create all visual effects in *DISPEL* – from Celeste's portal to the monster's transformation, and even Lizzie's minor injuries. Throughout the narrative of *DISPEL*, we were able to use fantastical sequences to address issues such as alcoholism and mental health.

I think the visual effects of magic and fantasy need to be rooted in production in order to make sense – whether that's the narrative itself, set design or lighting the space with a cinematographer. When you bring in visual effects, you enhance what's already been laid down in that base layer to create a comprehensive final shot.

It's easy to get distracted by the fun, flashy elements of a story when working





The protagonist's room, filled with world-building props and Easter eggs such as labelled cassette tapes, trading cards and posters

ABOUT THE DIRECTOR



Kylie Eaton is a genre filmmaker with a passion for fantasy, science fiction and all things other-worldly. She's a member of the Alliance of Women Directors and an advocate for ethnically diverse casting. Her narrative short film debut, *43 QUINTILLION*, premiered in 2018 at MidWest WeirdFest. It went on to collect several accolades, including Best Drama Short at the 2018 Sioux Empire Festival.

with sci-fi and fantasy. Filmmakers on a budget need to be especially careful here. Try to shoot what you can in-camera, use practical effects where possible, and then polish the overall look with computer graphics. Working with the actress behind *DISPEL*'s monster was slightly terrifying, because she was in make-up the whole time. She would arrive at 3 in the morning to get ready with the special effects make-up artist. I was so glad to see her real face when we re-recorded her dialogue later in post-production.

A film's soundtrack can also help to maximise the impact of visual effects, capitalising on a certain emotion or tone. Keep in mind the composer needs some creative freedom. It's counterintuitive to get too specific with a time signature or key, trust that the composer knows their technical elements. If you can approach them with a broader scope – a tone or

emotion pivotal to the scene in question – then you'll be pleasantly surprised with the results.

A final lesson

For a time I approached projects by asking 'what do people want?' or 'what's popular in cinema?' I never had much success with this approach. It's only when I began to think about my own passions and values that my films took off. A filmmaker's voice is the most valuable thing they have.

Other writers and directors might be just as talented, intelligent and experienced as you, but no one can match your unique voice, your own personal perspective. Think about what you want to see on the screen and try to translate that into your own work.

My hope for *DISPEL* was for a little girl to see her own face in a fantastical superhero. I think that's a really powerful message for young women today.

REVIEWS

We explore the latest software and hardware tools to see if they are worth your time or money

PORTABLE CREATIVITY

Has the iPad reached the stage where it could replace your desktop workstation?
We test six creation apps to find out

It's been ten years since Apple first unveiled the iPad as a lightweight device designed mainly for leisurely computing use, focused on email, web browsing and watching movies. Since then, each new generation of iPad hardware has become progressively more powerful, while the iPadOS software, its user interface and underlying ecosystem of APIs have become more sophisticated.

The iPad has evolved to become a device that's now just as capable of content creation as consumption, including audio and video editing as well as 2D and 3D graphic design. The most up-to-date iPads are now powerful enough to drive desktop-class 3D software, and are tools that can be used for modelling to a professional standard.

In the past you could just about tinker with 3D and graphics on the iPad, but the

limitations of the platform meant that you'd always need a real computer at hand. That's no longer true, thanks to the raw power of Apple's A-series of iPad processors, which are the fastest mobile chips on the market. They can outperform the best Android devices (in most tests) by 2:1, and are now on a par with laptops.

Granted, iPad hardware isn't at all suited for the kind of long final renders that take hours to complete on powerful workstations. It's the creative design, modelling and sculpting side of 3D projects where you can switch completely to an iPad environment.

And for portability the iPad wins hands down. All this computing power in such a thin and portable device means you can take your work to places where a laptop would be comparatively cumbersome.



“THE IPAD HAS
BECOME A DEVICE
JUST AS CAPABLE
OF CREATION AS
CONSUMPTION”

The portability that these models offer, allowing the efficiency and ease of creating wherever and whenever you want, makes an iPad purchase extremely worthwhile

THE HARDWARE

The iPad line-up currently includes four models – the entry-level iPad, the iPad Pro, the Mini and the Air – which have varying screen sizes, hardware features and price points. They all support Apple’s superb low-latency Pencil stylus, as well as third-party styluses, they all have high-resolution displays, and all offer enough performance to comfortably run any graphics software you can find in the App Store.

And all run Apple’s latest iPadOS, which brings the experience of using an iPad closer to a desktop OS, finally addressing on-going criticisms of the platform, as well as including easier file management and sharing.

The iPad Pro is the most capable, thanks to beefed-

up graphics hardware, more system memory and larger storage tiers up to 1TB. It has the best, lightest design with super slim bezels, USB-C support and a 120Hz display. It’s also really pricey, particularly with more storage.

But the six-core A12 processor in the more affordable iPad Mini and Air models packs a performance punch that makes either of these two the best option for most artists. Even though the quad-core A10 processor in the cheapest iPad is definitely no slouch, the iPad Mini and Air are worth the extra investment for the significantly higher performance, which will certainly be felt in 3D applications.

For a more traditional computing experience,

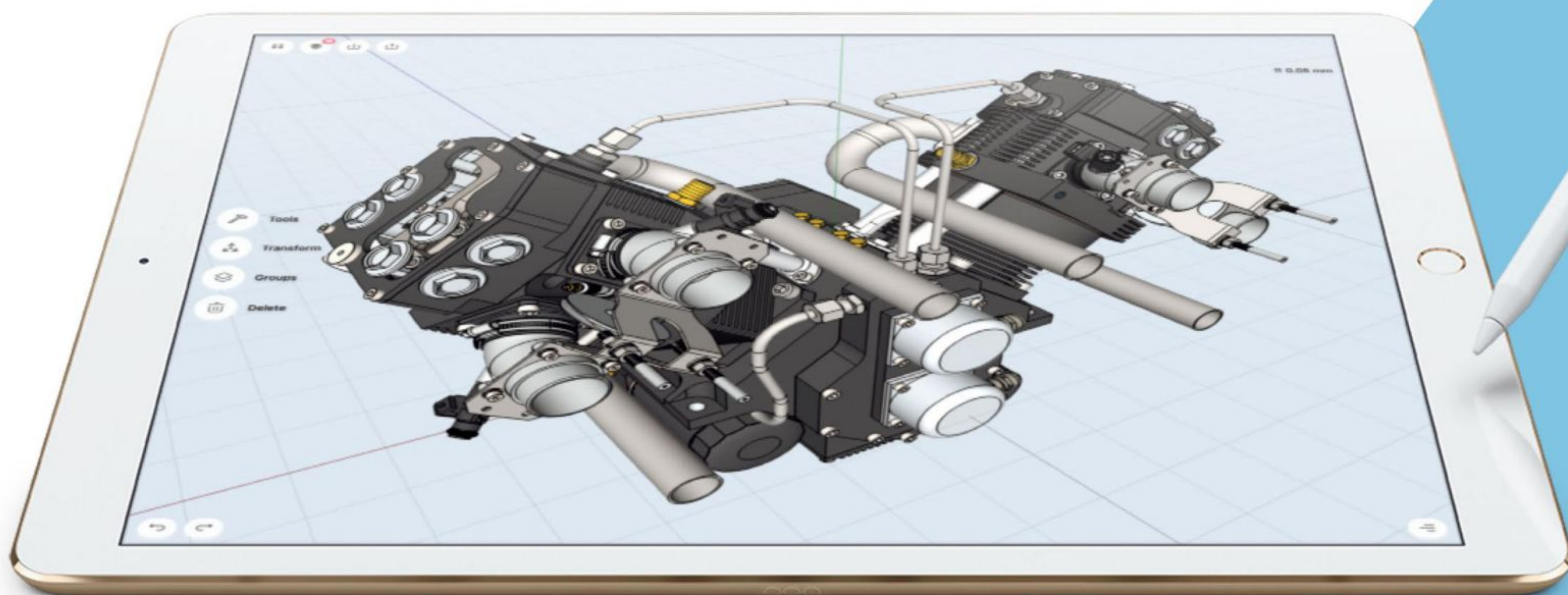


keyboards (usually as part of a folio case) work just fine on the iPad, and if you’re more comfortable using a mouse for 3D, the latest iOS now supports them too.

The iPad has now come of age, which is why over the next

few pages we’re going to take a look at some of the leading visual design apps the iPad has to offer, and assess whether a modern iPad graphics environment is a worthy substitute for the desktop.

THE SOFTWARE



Shapr3D

PRICE Free (for up to two designs) | **DEVELOPER** Shapr3D | **WEBSITE** shapr3d.com



Hailing from Budapest, Hungary, Shapr3D is a professional-grade CAD modelling app, based on the Siemens Parasolid geometric engine and HOOPS Exchange translation software. Designed for exclusive use with iPads that support Apple Pencil, CAD has been a tricky area to translate to the tablet format due to the lack of required precision. But this limitation has been overcome, thanks to the 9ms latency of the Apple Pencil and the performance of modern iPad hardware.

Shapr3D is sensibly offered for free as an entry point to learn the ropes of

the application, limited to low-resolution exports and a maximum of two designs but crucially, still giving access to all modelling tools.

The Pro version requires a reasonable monthly subscription of \$25 (or \$240 billed annually) to unlock features that allow Shapr3D to be used in a professional environment, including import and export of images, and to desktop CAD formats.

Shapr3D competes directly with the much pricier Onshape, a CAD platform that relies heavily on cloud processing, with interaction either via the web or tablet apps. But with Shapr3D, all processing is performed locally, and files are stored on the iPad, not in the cloud.

Interaction works using a combination of touch and stylus. Move the camera with a finger, and design your model with the Pencil.

Unlike some of the image editing tools (such as Affinity on the next

page) that try to cram every tool found in desktop software onto the iPad, Shapr3D isn't trying to ape every aspect of SolidWorks. Rather, it focuses on delivering a quality CAD iPad tool first and foremost – although CAD modelling veterans may find themselves crying out for some advanced features that haven't made the cut.

But on the whole, Shapr3D does CAD exceedingly well. It lets you set dimensions, drag shapes out with the Pencil and lay out a design as easily as you can with SolidWorks. When done, the model can be exported and then integrated into wider projects if required.

That said, CAD is a relatively new area for mobile, so we expect to see more complexity and options added over time, depending on how audiences react. The gap between tools such as Shapr3D and desktop CAD software will probably shrink even further in time.

VERDICT



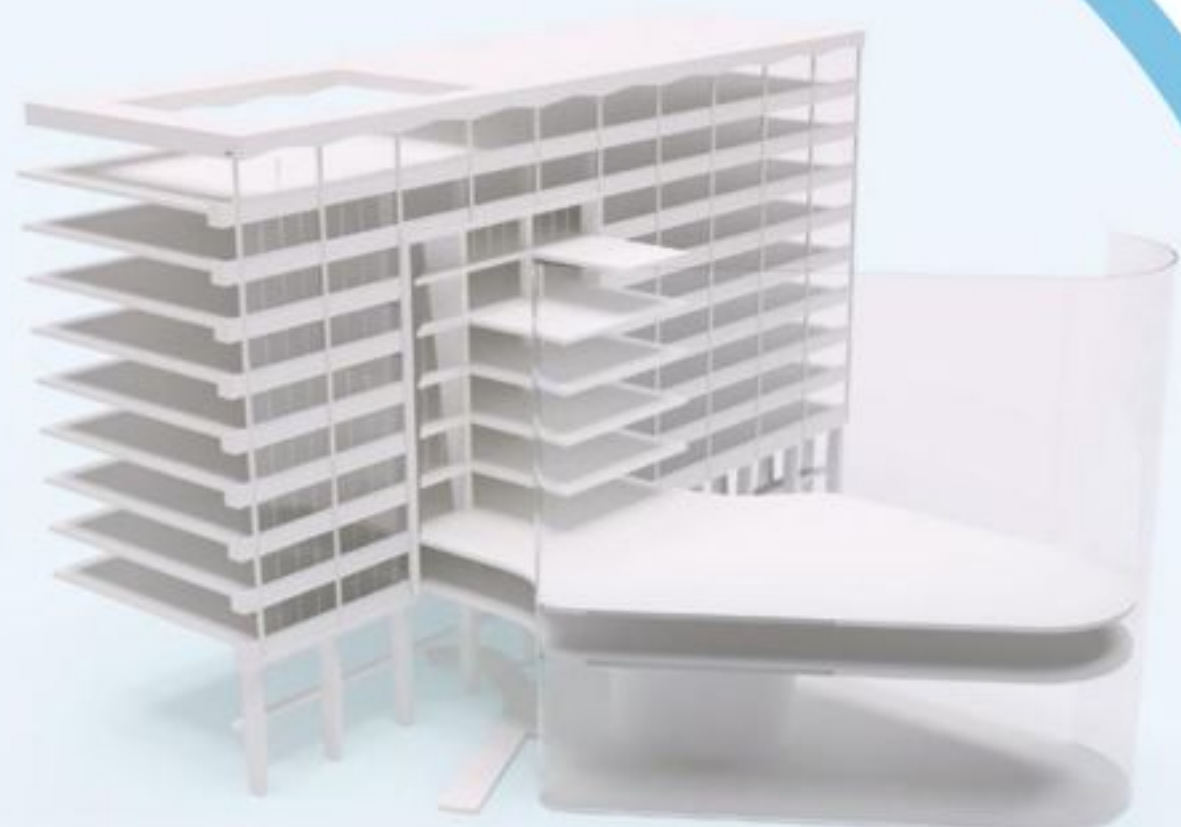
FEATURES

Exclusive to iPads with Apple Pencil

Set precise dimensions

Shape extrusion

Full-featured free version



Photoshop (preview)

PRICE N/A | DEVELOPER Adobe | WEBSITE adobe.com

The 2018 announcement of a forthcoming, full-fat version of Photoshop on the iPad, that works exactly like the desktop version without cutting out any features or flexibility, is a rubber stamping of our main argument in this article – that the iPad is now truly powerful enough to act as a substitute for desktop and laptop computers.

Adobe has already produced various graphic design apps for the iPad over the years, all of which have been decent, but ultimately limited versions of the desktop experience. At the heart of this new app is proper support for opening and saving PSD files, with unlimited layers just like on the desktop, adopting

a ‘pick up where you left off’ system where changes are synchronised via Creative Cloud. You can carry over your edits, brushes and layers from desktop to iPad and vice versa.

While all the desktop tools and functions are available in the iPad version, the user interface has been redesigned for touch-interface use, with heavy use of popover icons, single and double finger tapping and so on.

It’s unknown how well Photoshop veterans will adapt to this new UI. Much of their skill and speed at editing comes from years of use, with long-engrained muscle memory about keyboard shortcuts and menus that may be lost with this transition to

the iPad. Photoshop for iPad may therefore find it hard to establish itself on tablets in the same way it has on desktop computers, and instead may become just another tablet graphics app, competing hard against other tools.

Unfortunately, we won’t find out for a while, as we can only offer this info as a preview of Photoshop on the iPad, since the final version is still not ready. Adobe announced it would launch “in 2019” at a high-profile preview event last year, but the community has noticed few announcements have been made since. We wouldn’t be surprised to see it slip to 2020.

VERDICT

N/A

FEATURES
Full layer-based tablet editing
Cloud PSD files
Promised seamless transition from desktop Photoshop



Procreate

PRICE £9.99 | DEVELOPER Savage Interactive | WEBSITE procreate.art

The iPad now has some seriously powerful apps for most graphic design niches. But with a tablet that supports official and third-party stylus hardware that offers a new level of precision, a digital drawing app would seem a no-brainer. Enter Procreate, a digital illustration app that challenges the likes of Adobe Illustrator on the desktop.

Focused on vector graphics, with a range of drawing tools and a seriously comprehensive (over 130) brush library, Procreate leans towards character art, an area that’s already popular with artists who choose to hook up external tablets (such as Wacom’s Intuos) with a PC.

Because of this, we think there’s less of a change to workflow when switching from a tool like Illustrator to Procreate than there is when switching to a tablet in other areas of graphics, although some digital illustrators may disagree.

We mentioned the precision of iPad styluses, and this is particularly clear when using the Apple Pencil with Procreate. The Pencil just glides beautifully over the screen, almost as if it’s full of ink that’s just waiting to gush over paper to bring creations to life.

The tools within Procreate itself won’t disappoint either. You can turn a mock-up character into a multi-layered masterpiece image within the app, importing a range of file



types including PSD, BMP and JPG, although you might find yourself wishing for more advanced tools at times for general image manipulation.

And in the same way the experience of digital 3D sculpting is brilliant fun when using an app like Forger, 2D drawing is just great with Procreate. Apple even uses it to demonstrate the creative possibilities of iPad hardware, and it’s not hard to see why.

VERDICT



FEATURES

Over 130 custom brushes

Export layers to PDF/
PNG and GIF

Blend Modes, Groups and
PSD support

Uniform, Distort and Warp
transformation modes

30fps video support

FEATURES
Wide range of brush/ stroke/transform tools
Symmetrical shaping
Masks/layers
Lighting/painting
Left/right-handed UI

Forger

PRICE £9.99 | DEVELOPER Javier Edo | WEBSITE forgerapp.com



One of the challenges of iPad modelling is the limited quantity of highly polished and mature software applications. Finding a tool that works as well as anything on the desktop is rare, which is why Forger stands out.

The brainchild of Javier Edo, a talented artist in his own right, Forger aims to bring most features of Autodesk Mudbox over from the desktop to tablets, and in doing so has

even import an image to use as a brush. With Forger on iPad you can make intricate edits to your work, moulding the geometry of 3D shapes using either your finger or a stylus, which provides a somewhat tactile connection to 3D that you don't really get when using a mouse.

It imports and exports OBJ files (STL export is currently in testing), and has a particularly intuitive interface that has been tailored specifically for the iPad, with left/right-handed UI modes and an easily movable camera. Panning, rotating and zooming is achieved with the finger motions you might be used to in mobile apps: pinching to zoom, two finger swipes to move, and one finger to rotate.

Sculpting can be performed symmetrically, using masks and layers, with the ability to apply clear, grow, shrink, invert, blur and sharpen masks. You can merge and split meshes, and reapply symmetry with multiple undo levels to give more precision to edits.

You can light your models with Forger's PBR shader, which incorporates an image-based

lighting model, and afterwards your mesh can be painted directly on the iPad (although this feature requires an in-app purchase). After export, final lighting and rendering can then be completed on a desktop PC – leading to a workflow where the iPad is the creative tool and the workstation does the number crunching.

While Forger works on all iPads, it can be demanding. With higher subdivision levels and mesh resolutions, you might find yourself shutting down running apps in order to reclaim system memory. Flushing the undo history after a file save likewise restores some performance, which might be a fairly regular activity on older hardware.

With all the depth available in Forger that makes it a viable professional tool, its real strength is how it offers this while still allowing modelling on iPad to be great fun. A child could pick up Forger, select the human bust preset, and start mangling faces using their finger, learning the basics of modelling as they go.

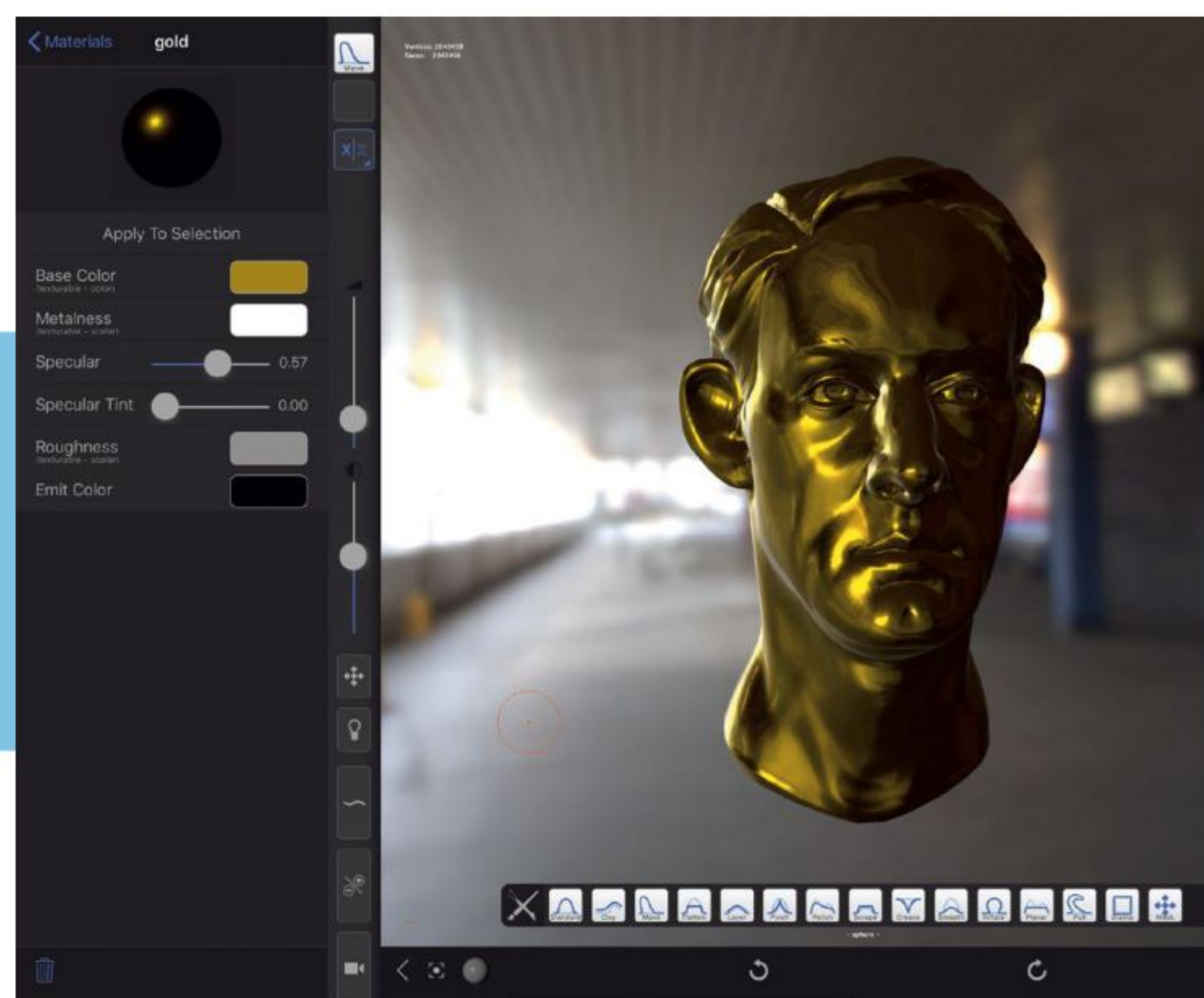
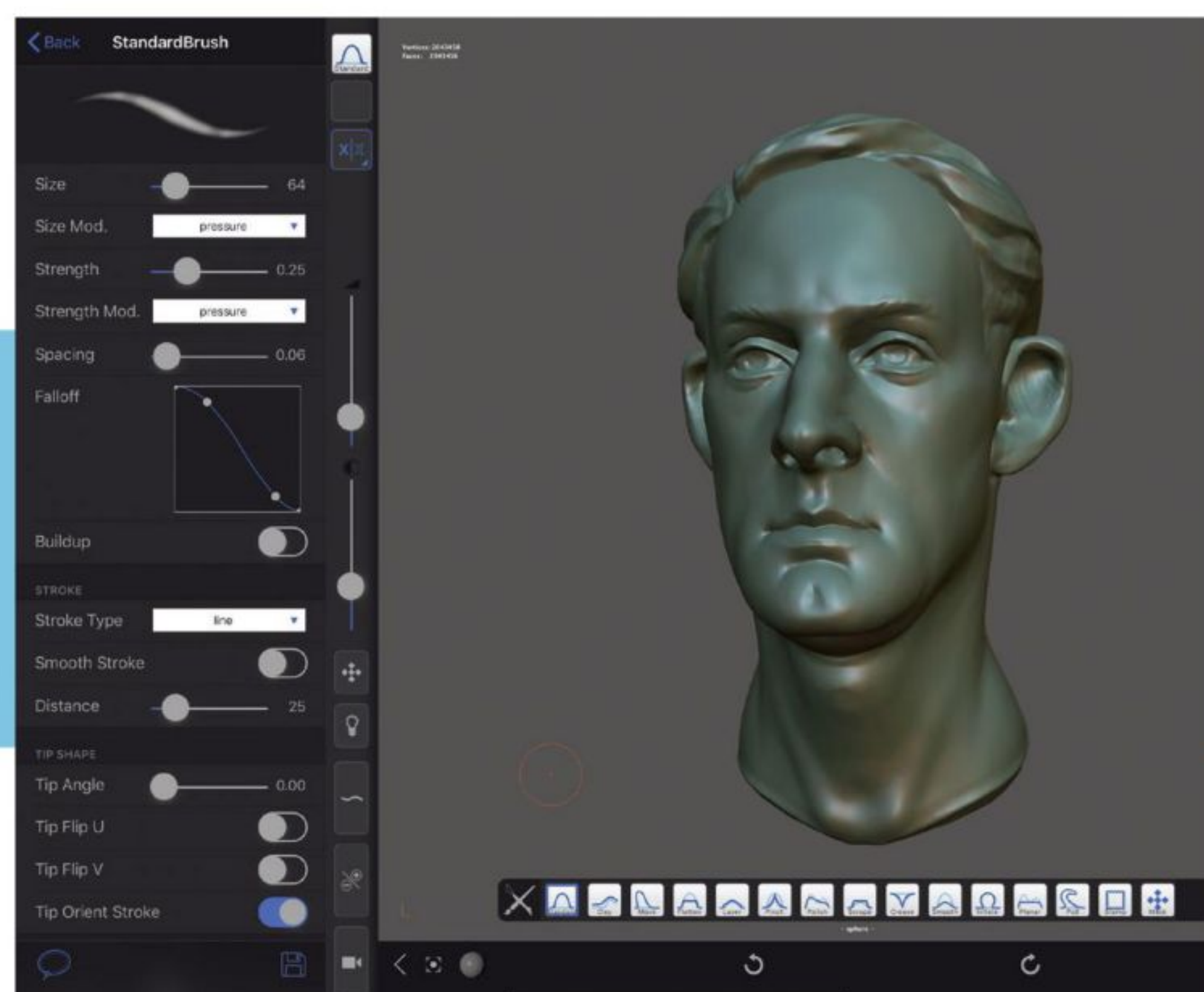
VERDICT



“FORGER’S STRONGEST POINT IS THE SHEER VOLUME OF BRUSH, STROKE AND TRANSFORM OPERATIONS AVAILABLE”

not only become the de-facto standard for tablet-based sculpting software, but a true showcase for how the addition of touch-sensitive hardware can make a real difference to 3D creativity.

Its strongest point is the sheer volume of brush, stroke and transform operations available, which are pretty much the equivalent of any desktop sculpting applications. Move, pull, flatten, bend, twist, translate, rotate your model or



Affinity Photo

PRICE £19.99 | DEVELOPER Serif | WEBSITE affinity.serif.com

On the Mac and Windows, Affinity Photo is a highly affordable alternative to Photoshop, a great way to avoid Adobe's subscription plans with a modest one-off purchase fee. The same applies to the iPad version.

But what's really great about Affinity isn't its affordability, but how truly powerful it is. It can do every advanced thing that Photoshop can, and gives you just as much control. That includes stacking bazillions of layers together, working with RAW files and batch processing. If you can think of anything you need, you'll probably find it's possible with Affinity. And just about everything from the desktop version is available too.

And while we're still waiting for Adobe to fully deliver

on its promise of seamless synchronisation between iPad and Mac desktops, Serif has already got there with the iPad version of Affinity. Save an Affinity document on a Mac and open it on an iPad (or vice versa) and you can pick up right where you left off, with the same brushes, masks, layers, and so on.

With so many features, the Affinity iPad interface is deep and complex, and it isn't a program that a beginner will likely be able to easily master in a short space of time. But the relatively low price of such a powerful tool means that there's no real excuse for graphics professionals of any discipline to not keep this tool on their iPad.

VERDICT



"AFFINITY PHOTO IS A
HIGHLY AFFORDABLE
ALTERNATIVE TO
PHOTOSHOP"

FEATURES
Full unlimited layer-based tablet editing
RAW image support up to 100 megapixels
iCloud Drive support for seamless file management



Pixelmator

PRICE £4.99 | DEVELOPER Pixelmator | WEBSITE pixelmator.com/ios

If Affinity Photo is the iPad's answer to Photoshop, then Pixelmator is perhaps more akin to Photoshop Elements. That's not a criticism, Pixelmator is also capable of powerful editing and can be used to create multi-layered images from the ground up.

But it's been designed to cater for advanced mobile photography more than graphic art. Pixelmator is naturally also available for the iPhone, with an interface that's more beginner-friendly than that of the iPad-only Affinity. It has over 100 brushes, effects and filters, colour adjustments, painting and selection tools, but these are primarily aimed at retouching existing photos. In

this way, anyone who is serious about mobile photography can easily create something that looks very impressive, add graphics or text to photos, turn them into collages, flip, rotate and transform them, touch up and enhance them.

The interface and beginner-friendly nature of Pixelmator shouldn't fool you though. Its engine can perform some powerful but subtle edits to images. Light processing can be done with just a few taps, making it possible to perform complex adjustments (such as lowering reflections on an object) without diving into too many settings.

It's also been around for some time now. Pixelmator

is one of the most mature graphics tools on iOS, and performs spectacularly. Notably, a new iPad-only app called Pixelmator Photo has just launched this year, with even more high-end photo editing tools that take advantage of modern iPad hardware such as machine learning, but even fewer features for creating images from the ground up.

We see no reason why Pixelmator and Affinity cannot coexist. They cater for two markets of mobile users, and at their low prices (compared with desktop image editing software), there's no reason not to own both.

VERDICT



FEATURES
100+ brushes
PSD support with layers
Hardware accelerated
iCloud Drive support



CONCLUSION

The traditional roots of 3D design (before computers) are in physical modelling and sculpting with real materials, just as those of 2D computer graphics are in drawing and painting with ink and real paint.

Touch interfaces have long promised to recreate many aspects of these traditional methods in the digital world, but both hardware and software have lacked the power and precision to pull it off successfully. It's only now that tablets have come of age and can really fulfil that potential.

We aren't suggesting the world is ready for all artists and modellers to throw their workstations out of the window and switch to tablets. Despite the recent advances in iPad hardware and software, the platform still has limitations.

Many artists can avoid tablets for now and continue to rely on tried and tested desktop and laptop computers for everything they do. And others will prefer to stick with a PC and use a drawing tablet plugged in as an accessory.

But the tablet computer form factor isn't going away and will only continue to improve. While we've only discussed the iPad due to its powerful hardware, wide market share and the maturity of iOS and the apps that run on it, we aren't forgetting Microsoft's excellent Surface tablets and various Android models that exist as alternatives. It's a big market and the devices are becoming considerably more powerful with each generation.

Developers are putting serious effort into making

interfaces as usable as possible for touch or stylus manipulation. Software synchronisation problems when working with multiple devices are no longer an issue. Many of the long-running criticisms of iOS in areas such as file sharing and external storage are also now close to being solved.

In the long term, it's only going to become harder to argue against tablets as an invaluable tool for modelling, with more of the workflow shifting away from the desktop and being contained within the tablet. You may wonder what the point of it is, but it's worth reiterating how portability is the key aspect of the tablet experience. Now that they're really powerful and there's enough quality tablet 3D software, you really can get on with serious modelling, sculpting or painting using a lightweight, easily portable device that's much less of a hassle to carry than even the thinnest laptop.

It can only be a good thing. It will lead to more creativity, and importantly it opens up the industry to a wider range of people with new skills and ideas, removing some of the barriers to entry that can be a turn off. One of these is pricing. So far, all the apps we have looked at are considerably more affordable than their desktop equivalents. Let's hope it stays that way.

As a final thought, it's worth considering the modern flexibility of tablets in parallel with other 3D technologies that

are in a nascent stage. This includes augmented reality, which Apple is investing in heavily, and modelling in virtual reality, best demonstrated with Sony's PS4 Move controllers and the *Dreams* software. 3D is shifting away from the big-box PC workstation paradigm to which we've been tied for so long. It's an exciting time.

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GET ON WITH
SERIOUS MODELLING,
SCULPTING OR
PAINTING USING
A LIGHTWEIGHT,
PORTABLE
DEVICE"



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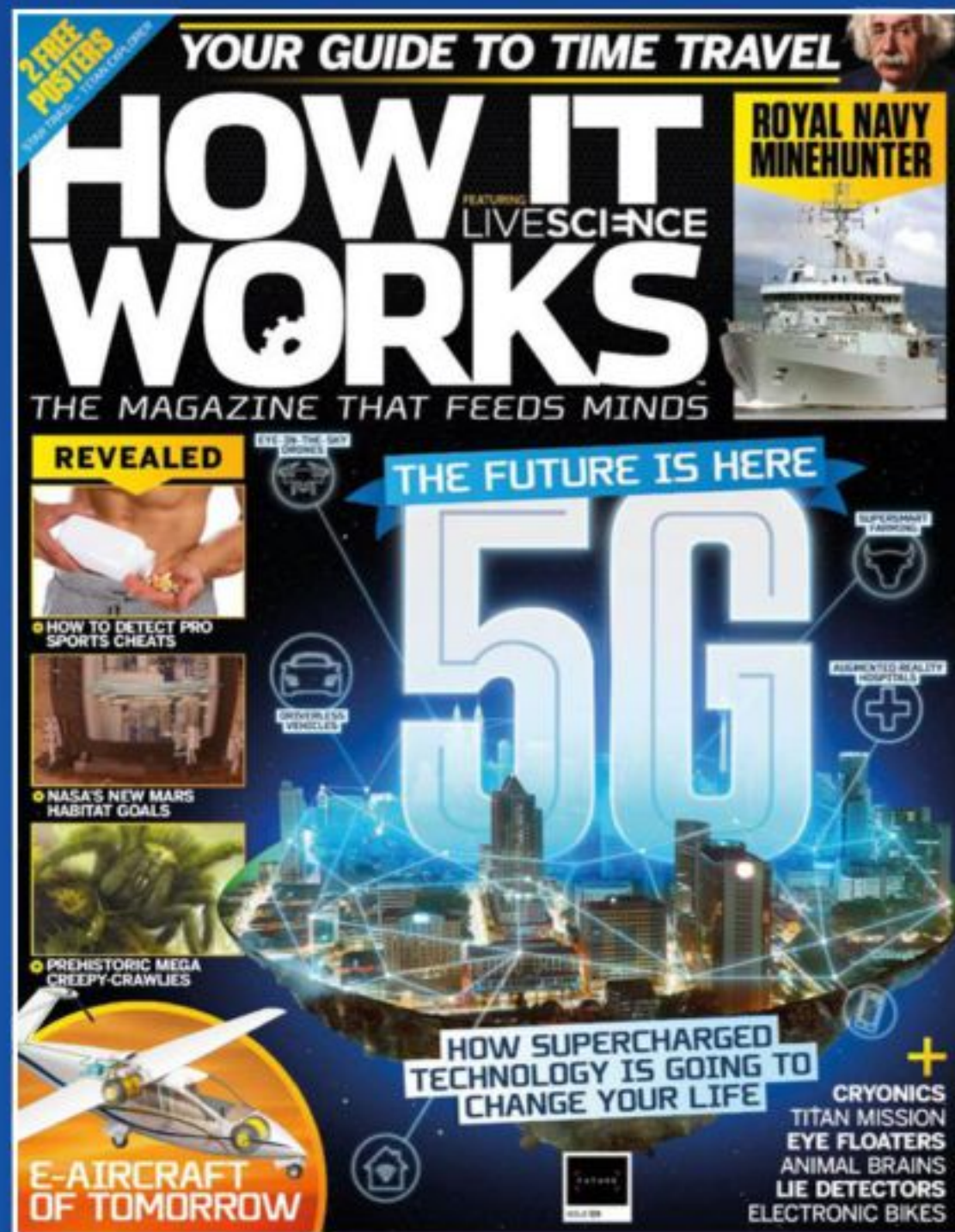


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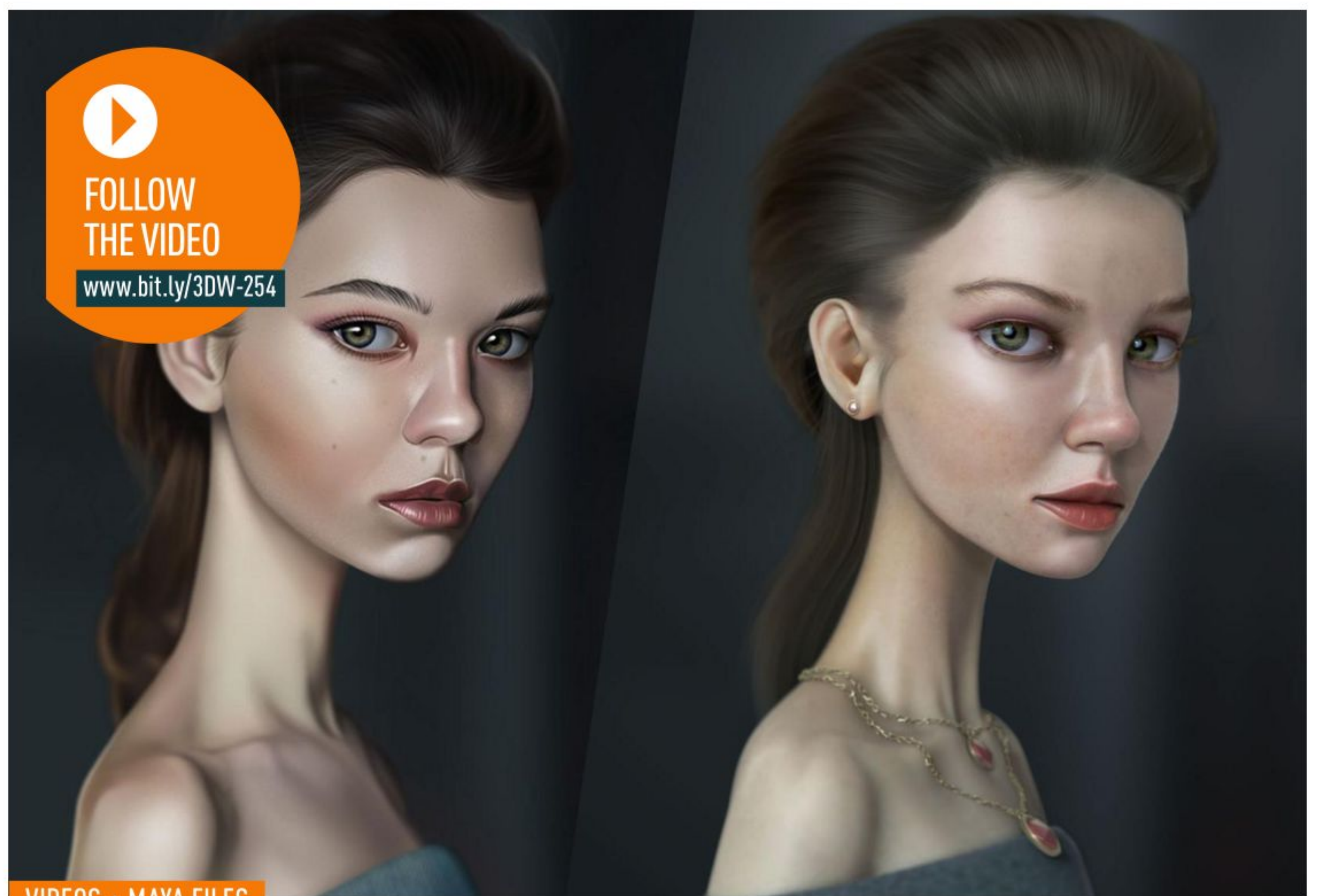
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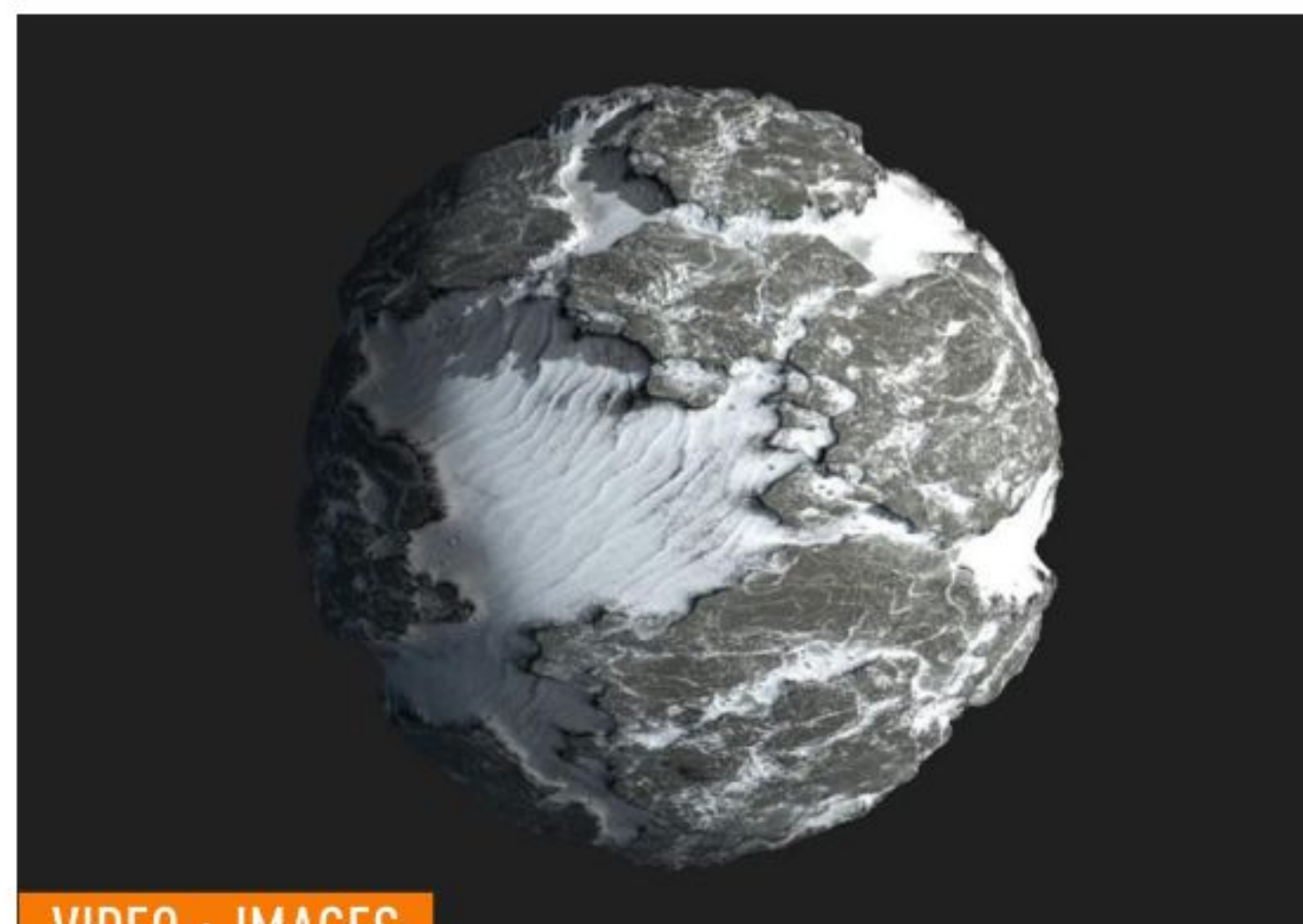
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VIDEO + IMAGES

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